FORTYFIRST ANNUAL REPORT
1989

Northwestern Agricultural Research Center
of the
Agricultural Experiment Station
Montana State University

4570 Montana 35
Kalispell, MT 59901

Prepared by

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Westland Seeds, Inc., Ronan
Lake Glacier View Farm, Ronan

1	MSU Western Agricultural Research Center

ADMINISTRATION 750

The Administration Project at the Northwestern Agricultural Research Center includes expenses for the overall operation of the center, personnel and office equipment purchased.

Full Time Staff Members	Years in Service
Vern R. Stewart - Supt. & Prof. Agronomy (Began April 1952)	37
Leon E. Welty - Assoc. Prof. Agronomy (Began January 1973)	16
Oscar Buller - Agric. Res. Tech. I (Began January 1984)	5
Jeanette Calbick - Secretary II (Began September 1963-- retired July 1989)	26
Gary Haaven - Ag Research Spec. I (Began April 1982)	7
Shirley Jones - Secretary II (Began June 1989)	.5
Todd Keener - Ag Research Spec. I (Began March 1978)	11
Louise Prestbye - Ag Research Spec. I (Began May 1983)	6

Student Employees:

Troy Brist (July 7 through September 8)

Todd Evenson (June 12 through September 15)

Dan Fisher (June 7 through June 30)

Donald Hyatt (May 30 through June 1)

Michael LaCroix (May 10 through May 15)

Amy Wilcox (June 5 through August 14)

GENERAL FARM 751

The General Farm Project (751) supports all research projects. This includes items purchased and used in the total research program. there were no major purchases during the year.

PHYSICAL PLANT 752

The Physical Plant Project (752) includes the maintenance of buildings and grounds at the Northwestern Agricultural Research Center.

Remodeling of the interior of the Crop Research Building was completed in 1989, which included adding another bathroom, two offices, a furnace room, utility-shower room and remodeling the existing bathroom. Expenses for this remodeling totaled $3,249.96. Other improvements include adding a concrete walk along the East side of the Crop Research Building and building storage shelves for office supplies.

ACTIVITIES 1989

Date	Activity	Who	Where
1/4	Foundation Seed Project Meeting	Stewart	Bozeman
1/12	Bigfork High School - Talk	Stewart	Bigfork
1/17-19	Montana Weed Control Assc. Meeting	Welty Stewart	Great Falls
1/18	ICI Americas Dinner	Stewart	Great Falls
1/20	NWARC and WARC Advis. Comm. meeting	Stewart Welty	Allentown
1/23-27	MAES Planning Conference	Stewart Welty	Bozeman
1/23	Straw & Clods	Stewart	Bozeman
1/24	Foundation Seed Project Committee	Stewart	Bozeman
2/9	Mint Producer Annual Meeting	Welty Stewart	Kalispell
2/10	Meeting with Chuck Stinger - mint	Stewart	Kalispell
2/10	Flathead Elec. Irrigation School	Stewart	Kalispell
2/14	Alfalfa Harvest Management - Talk	Welty	Belgrade
2/15	Montana Wheat & Barley Comm. - Talk	Stewart	Bozeman
2/15	Alfalfa Harvest Management - Talk	Welty	Deer Lodge
2/16	Ext. Serv. Economic Development Group	Stewart	Kalispell
2/16	Alfalfa Harvest Management - Talk	Welty	Hamilton
2/17	Ext. Serv. Education Program	Stewart	Ronan
2/17	Alfalfa Harvest Management - Talk	Welty	Ronan
2/22	Make KGEZ Radio Tape	Stewart	Kalispell
2/25	Equity Supply meeting - Talk	Stewart	Kalispell
2/28	Make KOFI Radio Tape	Stewart	Kalispell
3/2	Crops & Soils Day	Stewart Welty	Creston
3/15	Western Soc. Weed Sci. Conf. - Talk	Stewart	Honolulu, HI
3/18	Flathead Elec. Co-op Annual Meeting	Stewart	Kalispell
3/19	Opportunity for Economic Development	Welty	Kalispell
3/21-27	Flathead Farm Show	Stewart Welty	Kalispell
3/28	Pomona Grange Agric. Day Dinner	Stewart	Kalispell
4/11	Equity Winter Wheat Injury Meeting	Stewart	Creston
4/14	Eastside Grange Meeting - Talk	Stewart	Creston
5/11-12	ASA Planning Meeting	Stewart	Milwaukee, WI
6/8	Lake County Weed Tour	Stewart	Lake County
6/19-21	Western Soc. of Crop Science	Welty Stewart	Bozeman
7/11	Northern Agric. Res. Ctr. Field Day	Stewart	Havre
7/18	Eastern Agric. Res. Ctr. Field Day	Stewart	Sidney
7/20	Western Agric. Res. Ctr. Field Day	Stewart Welty	Corvallis
8/9	Field Plot Tour	Welty	Bozeman
9/5-6	Superintendents' Conference	Stewart	Lewistown
9/15	Ag Committee, Chamber of Commerce	Stewart	Kalispell
10/17	SCS Riparian Meeting	Welty	Plains
10/30-11/2	MAES/CES Annual Conference	Stewart Welty	Bozeman
11/3	Oil Seed Task Force Meeting	Welty	Bozeman
11/3	Montana AgResearch Editorial Board Mtg.	Welty	Bozeman
11/17	Ag Committee, Chamber of Commerce	Stewart	Kalispell

VISITORS 1989

Date	Visitors	Representing	From
2/3	Bob Sharp	Contractor	Kalispell
2/8	Dale Sonstelie	Farmer	Kalispell
2/22	Phil Clarke	Farmer	Kalispell
2/24	Rod Warner	Du Pont Company	Bozeman
3/1	Ivan Tyler	Farmer	Columbia Falls
3/28	Neal McAlpin	Farmer	Polson
3/29	Lee Buller	Creston Fire Dept.	Creston
	Dale Sonstelie	Farmer	Kalispell
	Don Graham	Ag Tech	Missoula
4/1	Marvin Kaufman	Former employee	Oregon
	Ronnie Pack	Contractor	Kalispell
4/3	Ray Zimmerman	Farmer	Kalispell
4/4	Ray Zimmerman	Farmer	Kalispell
4/20	David Grant	Cargil	
5/1	Bob Hindman	County Road Department	Kalispell
5/2	Michael LaCroix	Job Applicant	Kalispell
5/3	Amy Wilcox	Job Applicant	Kalispell
5/4	Shaun O'Lexey	Job Applicant	Kalispell
5/18	Ivan Tyler	Farmer	Columbia Falls
5/22	Bob Rost	Mo's Green House	Bigfork
5/23	Bob Rost	Mo's Green House	Bigfork
5/25	Marty	West. Ag Res. Center	Corvallis
5/26	Ray Ditterline	MSU Plant & Soil Science	Bozeman
5/26	Shaun Townsend	MSU Plant & Soil Science	Bozeman
5/26	Ken Krueger	Farmer	Kalispell
5/30	Don Graham	Ag Tech	Missoula
5/30	Patty Fisher	Job Applicant	Kalispell
5/31	Lorraine Rocheleau	Job Applicant	Kalispell
6/1	Eloise Delashmit	Job Applicant	Kalispell
	Shirley Jones	Job Applicant	Kalispell
	Bud Kumlien	Physical Plant-MSU	Bozeman
	Eric Raecke	Physical Plant-MSU	Bozeman
	Bill Rose	Physical Plant-MSU	Bozeman
6/2	Beryl Mahlum	Farmer	Kalispell
	Susan Babitt	Job Applicant	Worland, WY
	Mark Mullee	Job Applicant	
6/5	Kathryn Byrne	Job Applicant	Missoula
	Dan Fisher	Job Applicant	Kalispell
	Harold Small	Farmer	Kalispell
6/15	Gary Treweek	Contractor	Kalispell
6/27	Dick Lund	MSU Experiment Station	Bozeman
6/28	Steve Saunders	Dow Chemical	White Sulphur Springs
	Paul Ramsley	Dow Chemical	England
7/5	Anthony Walters	Job Applicant	Columbia Falls
	Dan Fisher	Former Employee	Kalispell
	Troy Brist	Job Applicant	Whitefish
7/6	AllTel	Phone repairman	Kalispell
7/7	George/Betty Gaiennie	Tourists	Lecompte, LA
7/13	Mal Westcott & crew	WARC	Corvallis
7/24	Gayward Cavanas	Ag Mechanics Teacher	Austin, TX

VISITORS, Continued

7/25	Dr. Cliff Bourne	Retired Soil Scientist	Bigfork
7/25	Dr. Kelso	Former MSU Dean of Agric.	Arizona
7/26	Celestine Lacey	Herbicide Evaluator	Helena
7/27	Bruce McCallum	County Agent	Kalispell
	Francis VanRinsum	Weed Supervisor	Kalispell
8/2	Pierre/Marc Thorsen	Student	St.Charles,IL
8/8	Roger Stewart & family	Tourists	Wisconsin
8/21	Glen	Torgerson's Implements	Ethridge, MT
8/25	Bob/Betty Tyman	Retired History Professor	Bowling Green, OH
8/28	John Green	Tourist	California
8/30	Richard/Barb Lavender	Farmers	Corvallis
9/13	Tim Wiersum	SCS Soil Scientist	Missoula
9/13	Mike King	DuPont	Billings
	Robbie Bratton	Dupont	Great Falls
9/19	Rachael Potter	Glacier Park employee	West Glacier
9/20	Bobbie Sumberg	Tourist	Olympia, Wa
9/28	Hutterites	Kingsbury Colony	Valier
10/11		Farmer	Virginia
10/11	Jim/Don McMann	Farmers	Alberta
10/11		Teacher	Oregon
10/11	Scientist & husband	USDA horticulturist	Maryland
10/18	Bob Erb	Cherry producer	Bigfork
10/27	Eric Raecke	MSU-Physical Plant	Bozeman
11/15	Stafford		Thompson Falls
11/15	Tom Gorton	Neighbor	Kalispell
11/17	Mark Passmore	Farmer	Kalispell
11/22	Vickie Rogers	Former employee	Kalispell
12/14	Darrell Adams	Ostrich rancher	Kalispell

CLIMATOLOGICAL DATA
NORTHWESTERN AGRICULTURAL RESEARCH CENTER
Kalispell, MT

Northwestern Agricultural Research Center climatological data is recorded and sent to the Atmospheric Administration to be published in the Climatological Data. Daily maximum and minimum temperatures, soil temperatures at four and eight inches and precipitation are recorded. This data has been recorded since January 1949.

Total precipitation was 23.39 inches, 120% of the 40 year average of 19.51 inches (crop year September 1, 1988 through August 31, 1989). There were four months below the average precipitation, but during July and August, there were 6.39 inches of precipitation, which was 3.23 inches above normal for these summer months.

The temperature mean was very close to normal with 42.5 degrees for the crop year with 43.2 degrees being the long time average. The lower mean was largely due to the low temperatures in February.

Since recording of climatological data began, the average number of frost free days over the years is 112 days. During this crop year, there were 110 frost free days.

The warmest daytime temperature for the crop year was 96 degrees on August 1. The coldest temperature was 20 degrees below zero on February 4 and 5.

The 1988-89 season was one of the most unusual in the history of the Northwestern Agricultural Research Center. Normal precipitation and temperatures were recorded for November through January except for October, when there was only 47% of normal precipitation. Snow cover was recorded this season at the end of November with 3 - 10 inches through January 19, 1989. On January 19, the air temperature was 38 - 45 degrees F. causing the snow to dissipate. On January 30, the maximum air temperature was 51 degrees. At 6:30 a.m. on January 31, at about 6:00 a.m., the temperature was 35 degrees with a high wind. There was a severe temperature drop with a short term blizzard which occurred about noon this date, dropping the temperature by noon to 2 degrees. By 6:00 p.m. on January 31, the temperature was 20 degrees F. below zero, with a wind velocity between 35 and 50 mph. This created a wind chill of 90 degrees below zero. This continued for approximately four days. Temperatures stayed quite low through the middle of February.

Because there was no snow cover on the ground during this cold interim, there was extensive damage to perennial crops, shrubs, winter wheat and cherry orchards. Up to 90% of the valley's wheat was lost, and slight to moderate damage to peppermint stands were reported. Up to 85% of the Flathead cherry orchards were destroyed by this cold weather. Alfalfa stands were reduced in exposed areas, yet the damage was not as pronounced as in other perennials. Snow fell on February 11 giving snow cover through March 24, but because of the frozen soil, there were considerable erosion and water loss at melt off.

There was continuous snow cover from November 28 through January 19 (53 days) and from February 11 through March 24 (39 days).

There were several months in the 1988-90 growing season which received above normal precipitation. September had 139% of normal, which helped in winter wheat seedings. Although there was less than half (47% of normal) moisture in October, normal amounts were received November through January. All other months received above normal precipitation except April and June, 78% and 74%, respectively.

Temperatures were cool to mild during the heading, resulting in no recording of plant aberrations. The dry June and wet, warm July did not provide favorable conditions for disease development as there were only minor incidences of plant diseases.

In August, precipitation received was 238% of normal with accompanying unseasonably cool temperatures toward the end of the month and into September, which made harvest very difficult. Lodging was prominent in most spring barley and wheat varieties, with sprouting being a major problem in both. Several nurseries were abandoned and no yield was taken due to severe lodgings, sprout damage and active regrowth.

Soil temperatures were normal throughout the season, when recorded (September through November and April through August).

Following is a list of tables giving a complete description of the weather for the crop year (September 1988 through August 1989) and 1989 (January through December).

Table 1. Summary of climatic data by months for 1988-89 crop year (September through August) and averages for the period 1949-89 at the Northwestern Agricultural Research Center, Kalispell, MT.

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1989. (Average)

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1989. (Maximum)

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1989. (Minimum)

Table 5. Summary of precipitation records at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 through August 31, 1989.

Table 1. Summary of climatic data by months for 1988-89 crop year (September thru August) and averages for the period 1949-89 at the Northwestern Agricultural Research Center, Kalispell, MT.

ITEM	Sept. 1988	Oct. 1988	Nov. 1988	Dec. 1988	Jan. 1989	Feb. 1989	Mar. 1989	Apr. 1989	May 1989	June 1989	July 1989	Aug. 1989	Total or Average
Precipitation (inches)													
Current Year	2.30	0.62	1.39	1.69	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69	23.39
Avg. 1949 to 1988-89	1.66	1.32	1.43	1.63	1.51	1.20	1.17	1.39	2.28	2.76	1.55	1.61	19.51
Mean Temperature (F)													
Current Year	53.8	47.5	36.3	23.3	27.5	12.4	28.8	44.2	49.6	59.8	65.4	61.9	42.5
Avg. 1949 to 1988-89	53.4	43.4	32.6	25.6	22.0	27.7	33.7	43.2	51.6	58.6	64.0	63.0	43.2
Last killing frost in spring													
1989					May 21 (32 degrees F)								
Avg. 1949-89					May 25								
First killing frost in fall													
1989					September 9 (29 degrees F)								
Avg. 1949-89					September 13								
Frost Free Period													
1989					110 days								
Avg. 1949-89					112 days								
Maximum summer temperature					96 degrees F on August 1, 1989								
Minimum winter temperature					20 degrees F below zero on February 4 & 5, 1989								

In this summary 32 degrees is considered a killing frost.

Table 2. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31,1989.

Average temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
1949-50	54.1	41.5	38.5	25.0	4.2	25.6	31.2	41.9	49.7	57.0	64.0	62.5	41.3
1950-51	53.8	45.9	31.5	29.5	20.2	27.7	27.0	42.1	50.0	54.2	64.7	60.4	42.3
1951-52	50.6	40.8	30.8	16.9	18.0	26.6	29.3	45.8	52.4	56.7	61.8	62.8	41.0
1952-53	56.0	45.5	30.4	27.6	36.0	32.9	37.2	41.2	49.5	54.6	64.3	63.1	44.9
1953-54	56.1	46.2	37.0	31.3	21.1	31.2	29.6	40.8	52.5	54.9	63.4	60.1	43.7
1954-55	52.9	41.5	38.8	28.8	25.7	22.1	24.5	39.1	47.7	58.8	62.7	62.2	42.1
1955-56	52.5	44.6	23.5	21.8	23.3	20.9	31.5	44.2	54.0	59.0	64.8	62.0	41.8
1956-57	55.2	44.1	30.9	28.5	10.2	23.4	33.3	43.7	55.6	59.7	65.4	62.4	42.7
1957-58	55.8	41.4	32.1	32.4	29.1	30.4	32.2	43.6	59.6	62.3	65.2	67.9	46.0
1958-59	55.5	44.6	32.8	28.2	24.7	23.1	35.3	45.2	48.1	59.9	64.5	61.0	43.6
1959-60	53.0	43.9	25.5	27.6	19.4	25.2	32.3	44.3	50.6	59.6	68.8	60.6	42.6
1960-61	55.0	45.2	34.4	24.9	27.8	37.0	38.3	42.0	52.6	64.7	66.2	67.8	46.3
1961-62	49.6	42.3	28.2	23.6	17.4	25.7	30.9	47.2	51.5	58.6	62.1	62.1	41.6
1962-63	54.7	44.7	38.0	32.5	11.8	33.1	38.7	43.2	51.4	59.4	63.0	64.9	44.6
1963-64	58.7	47.4	35.8	24.0	28.5	28.3	30.6	42.8	51.1	58.7	64.3	58.9	44.1
1964-65	51.2	43.7	33.7	22.1	30.2	28.7	28.6	45.2	50.6	57.6	64.6	63.6	43.3
1965-66	46.4	47.6	35.0	28.8	26.3	27.7	34.5	42.9	54.3	56.0	64.5	61.7	43.8
1966-67	59.3	43.4	33.4	30.2	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	45.7
1967-68	61.0	45.9	33.8	25.2	23.3	32.8	41.2	42.0	49.8	59.0	64.6	61.3	45.0
1968-69	53.8	42.9	33.4	19.9	13.1	24.0	29.6	47.1	53.9	58.8	62.3	63.6	41.9
1969-70	56.0	40.0	35.2	27.7	21.9	29.9	32.8	40.2	53.2	62.0	64.8	62.6	43.9
1970-71	48.7	40.1	31.3	26.2	23.6	29.9	33.2	43.6	52.5	54.9	61.9	68.2	42.8
1971-72	49.5	40.4	34.1	22.2	17.0	27.3	38.5	40.6	51.9	59.3	61.5	65.9	42.4
1972-73	50.2	40.3	33.7	19.9	20.7	27.8	37.7	42.2	51.5	57.5	65.1	64.5	42.6
1973-74	53.3	44.1	29.3	30.8	21.0	32.3	33.6	42.7	48.0	61.5	64.8	61.6	43.6
1974-75	52.8	43.6	34.8	30.1	21.5	21.5	29.9	37.6	48.6	55.9	69.1	59.8	42.1
1975-76	52.1	42.9	35.4	27.5	27.7	29.9	31.0	43.4	51.9	54.5	63.4	61.3	43.4
1976-77	55.2	42.4	33.1	28.6	20.0	30.9	34.4	45.0	49.7	61.5	62.6	62.8	43.9
1977-78	51.7	42.5	30.4	22.0	21.6	26.1	34.3	43.7	48.1	59.1	63.4	60.3	41.9
1978-79	53.7	43.7	27.2	18.8	4.1	24.9	34.7	42.3	51.5	59.4	65.0	65.4	40.9
1979-80	56.9	46.6	30.7	33.0	16.3	29.0	32.6	47.1	54.8	56.9	63.5	58.6	43.8
1980-81	54.1	45.3	35.8	32.2	30.1	31.3	38.5	44.5	52.5	53.8	62.8	66.4	45.6
1981-82	55.3	43.2	36.0	27.0	21.6	24.5	37.5	39.4	49.8	59.8	61.1	63.0	43.2
1982-83	53.4	41.0	29.1	25.9	30.3	33.8	37.9	42.4	51.9	57.6	59.6	65.4	44.0
1983-84	50.4	42.9	36.6	11.1	27.6	32.4	38.3	42.2	48.7	56.4	65.3	64.6	43.0
1984-85	49.5	40.0	32.6	20.6	19.2	19.0	30.8	44.8	53.7	57.6	68.3	60.2	41.4
1985-86	47.8	40.8	18.6	18.3	25.4	25.6	40.6	43.8	53.7	63.9	59.9	66.1	42.0
1986-87	50.2	43.0	30.3	24.9	22.2	27.9	35.0	47.8	55.6	61.6	62.9	59.8	43.4
1987-88	56.1	43.3	35.3	25.4	20.5	30.3	37.8	45.7	51.4	60.9	63.7	63.9	44.5
1988-89	53.4	43.4	36.3	23.3	27.5	12.4	28.8	44.2	49.6	59.8	65.4	61.9	42.2
MEAN	53.4	43.3	32.6	25.6	22.0	27.7	33.7	43.2	51.6	58.6	64.0	63.0	43.2

Mean temperature for all years = 43.2

Table 3. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1989.

Average maximum temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
1949-50	71.4	52.4	45.7	32.1	14.4	34.6	38.4	52.3	63.1	70.1	78.6	79.5	52.7
1950-51	70.9	55.8	38.2	36.3	28.7	36.6	37.3	57.9	63.2	66.6	82.4	77.0	54.2
1951-52	64.2	47.5	37.2	23.6	25.9	35.7	39.5	61.8	65.7	70.2	79.2	79.5	52.5
1952-53	73.4	62.6	40.6	33.2	41.3	39.1	46.8	51.5	62.5	66.8	83.3	79.5	56.7
1953-54	72.3	61.0	45.6	36.7	29.1	38.4	40.0	51.0	67.2	67.0	80.1	74.4	55.2
1954-55	66.4	53.4	45.9	34.9	31.8	31.2	33.9	48.1	60.5	74.7	76.9	82.4	53.3
1955-56	67.6	55.5	30.8	29.2	30.7	30.1	39.7	57.4	67.5	73.3	81.2	77.8	53.4
1956-57	71.0	53.7	37.6	35.5	19.0	33.2	43.3	55.3	70.2	72.4	82.1	80.0	54.4
1957-58	74.3	50.5	40.1	38.5	33.7	37.9	43.5	54.4	77.5	75.7	80.8	85.5	57.7
1958-59	69.7	57.9	39.6	34.1	31.8	31.9	43.9	57.9	61.5	74.3	83.2	76.3	55.2
1959-60	64.0	53.6	33.9	33.3	27.5	34.1	43.4	56.1	63.0	74.8	88.7	74.1	53.9
1960-61	72.1	57.8	41.1	29.8	35.0	43.1	48.2	51.6	65.3	82.0	83.7	86.3	58.0
1961-62	62.3	53.3	35.1	30.4	26.0	33.4	40.5	60.7	62.7	74.2	79.2	77.5	52.9
1962-63	71.7	54.7	43.8	37.9	19.9	41.4	48.9	55.7	67.1	71.8	79.6	82.5	56.3
1963-64	74.6	59.4	43.4	30.2	35.1	37.7	39.7	53.3	63.5	71.4	80.3	72.9	55.1
1964-65	63.9	55.0	41.0	28.9	35.1	36.9	41.0	57.6	64.3	71.4	80.8	77.1	54.4
1965-66	57.5	61.1	42.6	35.4	31.8	35.3	45.4	54.8	69.8	69.1	81.2	78.4	55.2
1966-67	74.9	55.1	41.1	35.8	36.7	40.9	41.3	52.6	66.0	73.3	84.8	87.2	57.5
1967-68	78.9	55.8	41.3	30.8	31.5	40.8	52.6	54.2	63.4	72.2	82.7	75.7	56.7
1968-69	65.9	53.1	40.6	27.3	20.8	32.5	40.9	59.5	68.7	72.0	78.9	83.0	53.6
1969-70	70.4	49.7	43.0	32.8	28.5	36.2	42.5	49.7	67.9	75.5	79.1	80.9	54.7
1970-71	62.5	52.2	40.0	34.1	30.6	38.6	41.6	56.2	66.4	67.3	78.0	87.5	54.6
1971-72	64.2	53.1	41.2	30.9	27.1	35.9	47.9	51.7	64.7	72.4	76.9	83.3	54.1
1972-73	64.0	51.3	41.4	28.6	30.6	38.5	47.7	53.8	65.8	69.6	83.7	83.2	54.9
1973-74	67.6	56.3	36.8	36.5	28.5	39.6	43.5	53.1	59.2	76.2	80.3	77.6	54.6
1974-75	70.9	61.4	43.2	37.4	32.0	31.5	39.4	48.1	61.2	68.5	85.5	73.0	54.3
1975-76	69.4	52.3	40.4	35.1	36.2	37.6	40.1	54.3	66.2	66.3	79.0	74.4	54.3
1976-77	73.2	57.7	42.1	36.1	28.0	39.1	42.7	60.2	61.9	77.0	76.6	77.4	56.0
1977-78	64.7	55.4	38.5	29.4	28.8	35.5	45.5	54.3	58.1	72.6	77.5	74.2	52.9
1978-79	65.7	59.2	35.9	28.2	13.7	33.2	45.3	52.5	64.3	73.9	81.5	82.8	53.0
1979-80	74.1	59.5	37.8	39.2	25.2	35.9	40.8	60.4	66.9	69.0	77.0	73.2	54.9
1980-81	66.9	59.0	43.9	39.2	34.0	38.9	49.7	54.8	63.3	63.8	78.1	85.0	56.4
1981-82	70.8	54.1	44.9	34.2	29.7	33.3	45.8	50.5	62.5	74.3	75.0	80.6	54.6
1982-83	69.2	53.2	36.9	33.0	36.8	42.2	47.5	55.2	66.4	70.6	73.1	82.9	55.6
1983-84	65.1	56.0	43.7	19.9	34.6	40.8	46.8	54.2	60.4	69.1	82.8	83.3	54.7
1984-85	63.9	52.2	40.4	28.2	25.3	29.1	42.7	56.8	68.7	73.2	88.0	75.0	53.6
1985-86	60.4	51.3	26.7	25.2	34.0	36.6	51.6	55.1	66.1	78.5	73.0	84.1	53.6
1986-87	59.9	54.3	38.0	30.9	29.5	34.2	43.4	61.3	67.9	75.7	76.5	74.9	53.9
1987-88	73.5	59.9	43.0	32.6	29.0	39.3	46.1	58.5	63.8	74.1	79.5	82.6	56.8
1988-89	69.0	62.0	42.7	30.3	35.3	21.8	36.1	56.6	61.1	72.6	81.6	75.0	53.7
MEAN	68.3	55.5	40.1	32.4	29.6	36.1	43.4	55.0	64.9	72.1	80.3	79.4	54.8

Mean temperature for all years = 54.8

Table 4. Summary of temperature data at the Northwestern Agricultural Research Center on a crop year basis, September 1, 1949 thru August 31, 1989.

Average minimum temperature by month and year
Degrees Fahrenheit

YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
1949-50	36.7	35.0	31.2	17.8	-6.0	16.6	23.9	31.5	36.3	43.9	49.4	45.5	30.2
1959-51	36.6	36.0	24.8	22.6	11.7	18.8	16.6	26.2	36.7	41.7	46.9	43.7	30.2
1951-52	37.0	34.0	24.4	10.1	10.0	17.4	19.1	29.8	39.1	43.1	44.3	46.1	29.5
1952-53	38.6	28.3	20.2	21.9	30.6	26.7	27.5	30.9	36.5	42.3	45.3	46.7	33.0
1953-54	39.8	31.4	28.4	25.9	13.1	24.0	19.2	30.6	37.7	42.8	46.7	45.7	32.1
1954-55	39.3	29.5	31.6	22.7	19.5	13.0	15.0	30.0	34.9	42.8	48.5	42.0	30.7
1955-56	37.3	33.6	16.1	14.4	15.9	11.7	23.3	30.9	40.5	44.7	48.2	46.1	30.2
1956-57	39.4	34.4	24.2	21.5	1.4	13.6	23.2	32.0	40.9	47.0	48.7	44.8	30.9
1957-58	37.2	32.3	24.1	26.2	24.5	22.8	20.9	32.8	41.7	48.8	49.5	50.3	34.3
1958-59	41.2	31.2	26.0	22.2	17.5	14.2	26.6	32.4	34.7	45.4	45.8	45.6	31.9
1959-60	42.0	34.1	17.0	21.8	11.2	16.3	21.1	32.4	38.1	44.3	48.8	47.0	31.2
1960-61	37.9	32.5	27.6	19.9	20.6	30.9	28.4	32.3	39.8	47.4	48.7	49.2	34.6
1961-62	36.8	31.2	21.2	16.8	8.7	17.9	21.2	33.7	40.3	43.0	45.0	46.6	30.2
1962-63	37.6	34.6	32.2	27.1	3.7	24.7	28.4	30.6	35.7	47.0	46.4	46.9	32.9
1963-64	42.7	35.3	28.1	17.7	21.8	18.9	21.4	32.2	38.6	46.0	48.3	44.9	33.0
1964-65	38.4	32.3	26.4	15.3	25.3	20.4	16.2	32.7	36.9	43.8	48.4	50.0	32.2
1965-66	35.2	34.0	27.4	22.1	20.8	20.0	23.6	30.9	38.7	42.8	47.7	45.0	32.4
1966-67	43.6	31.7	25.6	24.6	25.3	25.5	24.5	28.6	38.4	45.4	47.4	47.2	34.0
1967-68	43.1	35.9	26.3	19.4	15.0	24.8	29.7	29.8	36.1	45.7	46.4	46.8	33.3
1968-69	41.7	32.6	26.1	12.5	5.4	15.4	18.2	34.6	39.0	45.5	45.7	43.5	30.0
1969-70	41.6	30.3	27.4	22.6	15.3	23.4	23.0	30.7	38.5	48.2	50.5	44.3	33.0
1970-71	34.9	27.9	22.5	18.3	16.5	21.0	24.8	31.0	38.6	42.3	45.7	48.8	31.0
1971-72	34.7	27.6	26.9	13.5	7.7	18.6	29.0	29.0	39.2	46.3	45.8	48.5	30.6
1972-73	36.4	29.2	25.9	11.1	11.0	17.4	27.8	29.6	36.4	44.4	46.5	45.8	30.1
1973-74	38.9	32.0	21.8	25.2	13.5	25.1	23.6	32.4	36.7	46.9	49.5	45.6	32.6
1974-75	34.7	25.7	26.3	22.9	10.9	11.5	20.4	27.1	36.1	43.3	52.7	46.5	29.8
1975-76	34.7	33.4	30.3	20.0	19.1	22.2	22.0	32.4	37.6	42.6	47.8	48.3	32.5
1976-77	37.2	27.2	24.1	21.1	12.0	22.6	26.1	29.9	37.4	46.0	48.5	48.2	31.7
1977-78	38.6	29.5	22.2	14.6	14.5	16.7	23.2	33.1	38.1	45.6	49.2	46.4	31.0
1978-79	41.7	28.3	18.4	9.3	-5.6	16.5	24.0	32.1	38.7	44.9	48.5	48.0	28.7
1979-80	39.7	33.7	23.6	26.8	7.5	22.1	24.5	33.7	42.7	44.7	50.0	44.0	32.8
1980-81	41.3	31.6	27.7	25.1	26.2	23.8	27.2	34.2	41.7	43.7	47.6	47.8	34.8
1981-82	39.7	32.2	27.0	19.8	13.5	15.7	29.2	28.4	37.2	45.3	47.3	45.4	31.7
1982-83	37.6	28.8	21.4	18.7	23.7	25.3	28.4	29.5	37.5	44.7	46.1	48.0	32.5
1983-84	35.6	29.7	29.5	2.4	20.6	24.0	29.9	30.2	37.1	43.6	47.8	46.0	31.4
1984-85	35.2	27.7	24.7	13.0	13.2	9.0	18.8	32.7	38.7	42.0	48.5	45.5	29.1
1985-86	35.2	30.2	10.6	11.4	16.9	14.5	29.6	32.5	41.3	49.3	46.8	48.1	30.5
1986-87	40.5	31.6	22.6	18.8	14.9	21.6	26.6	34.2	43.3	47.4	49.4	44.7	33.0
1987-88	38.7	26.5	27.6	18.1	11.5	21.3	29.5	33.0	39.0	47.7	47.9	45.2	32.2
1988-89	38.6	32.9	29.8	16.3	19.7	2.9	21.4	31.8	38.1	46.9	49.3	48.7	31.4
MEAN	38.4	31.4	25.0	18.8	14.5	19.2	23.9	31.3	38.4	45.0	47.8	46.4	31.7

Mean temperature for all years = 31.7

Table 5. Summary of precipitation records at the Northwestern Agricultural Reserch Center on a crop year basis, September 1, 1949 thru August 31, 1989.

	Total precipitation in inches by month and year												
YEAR	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	MEAN
1949-50	1.03	1.05	1.67	0.92	2.62	1.13	2.31	0.84	0.15	3.90	3.12	0.75	19.49
1950-51	0.52	2.30	1.16	2.48	0.94	1.29	0.62	2.32	3.77	2.26	1.03	2.86	21.55
1951-52	1.49	5.62	1.01	3.31	1.03	0.98	0.97	0.17	1.32	3.95	0.56	0.69	21.10
1952-53	0.13	0.05	0.60	0.98	1.84	1.14	0.98	2.07	2.00	3.31	T	1.62	14.72
1953-54	0.71	0.03	0.87	1.30	2.65	0.79	0.83	0.79	1.52	2.98	2.91	3.79	19.17
1954-55	1.09	0.54	1.00	0.43	1.00	1.31	0.44	0.82	1.18	1.86	3.08	0.00	12.75
1955-56	1.64	1.89	1.97	2.38	1.76	1.53	0.87	1.28	1.06	4.20	2.13	3.21	23.92
1956-57	1.16	1.10	0.53	0.96	1.47	1.14	0.75	1.22	1.75	2.51	0.52	0.78	13.89
1957-58	0.10	1.59	0.96	1.76	1.56	2.67	0.97	1.47	2.20	2.56	0.84	0.58	17.26
1958-59	1.99	1.16	2.90	2.77	1.95	1.33	0.75	1.62	4.10	1.75	T	0.91	21.23
1959-60	4.22	3.36	4.32	0.34	1.67	1.10	1.01	1.23	3.27	0.69	0.13	2.43	23.77
1960-61	0.55	1.44	1.72	1.24	0.65	1.46	1.96	2.26	4.02	1.45	0.76	0.64	18.15
1961-62	3.40	1.22	1.77	2.09	1.33	1.15	1.59	0.96	2.59	1.15	0.11	0.72	18.08
1962-63	0.58	1.85	1.31	0.91	1.69	1.21	0.85	1.07	0.57	5.00	1.44	2.10	18.58
1963-64	1.46	0.75	0.95	1.70	1.46	0.41	1.57	0.87	3.33	3.86	3.01	1.64	21.01
1964-65	2.27	0.85	1.62	3.62	2.25	0.64	0.24	2.55	0.81	2.30	1.15	4.74	23.04
1965-66	1.72	0.21	1.31	0.55	1.42	0.67	0.53	0.76	1.18	6.57	2.49	1.64	19.05
1966-67	0.79	1.34	3.33	1.68	1.50	0.62	1.27	0.99	1.30	2.53	0.02	0.01	15.38
1967-68	0.91	1.88	0.62	1.16	0.79	1.15	0.68	0.57	3.92	2.22	1.00	3.42	18.32
1968-69	4.51	2.39	1.59	3.12	3.05	0.75	0.69	1.39	1.19	5.21	0.70	0.09	24.68
1969-70	1.54	1.90	0.31	1.14	3.10	0.89	1.49	0.76	1.97	4.37	3.08	0.44	20.99
1970-71	1.79	1.38	1.75	0.99	1.84	0.77	0.69	0.58	2.45	4.42	1.31	1.11	19.08
1971-72	0.94	0.87	1.70	1.62	1.10	1.65	2.11	0.95	1.48	3.28	1.77	0.98	18.45
1972-73	1.38	1.84	0.80	2.19	0.52	0.56	0.70	0.45	1.13	2.14	0.01	0.63	12.35
1973-74	1.37	1.41	2.95	1.94	1.35	1.32	1.40	3.36	1.82	1.80	1.01	0.62	20.35
1974-75	0.80	0.12	1.10	1.31	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	16.98
1975-76	1.18	2.96	0.85	1.39	0.91	1.12	0.34	1.92	1.90	2.49	1.49	3.42	19.97
1976-77	0.96	0.62	0.73	0.86	0.83	0.71	1.40	0.41	2.90	0.52	3.60	1.50	15.04
1977-78	2.84	0.56	1.62	4.10	2.15	0.99	0.72	2.54	3.56	2.63	3.90	3.34	28.95
1978-79	1.90	0.15	0.96	0.91	1.70	1.45	0.82	2.33	2.67	1.23	0.40	1.79	16.31
1979-80	1.03	1.75	0.50	1.03	1.53	2.03	0.97	1.88	5.48	3.89	1.08	2.45	23.62
1980-81	1.20	0.83	0.78	2.58	1.81	1.85	2.17	1.75	3.86	4.70	1.17	0.96	23.66
1981-82	0.77	0.56	1.49	1.91	2.38	1.48	1.16	1.60	1.25	2.41	2.06	1.17	18.24
1982-83	2.37	0.75	1.39	1.60	0.93	0.85	1.71	2.41	1.20	2.96	3.66	1.16	20.99
1983-84	1.70	1.13	1.96	2.57	0.80	2.19	1.81	1.93	2.91	2.07	0.31	0.55	19.93
1984-85	2.15	2.25	1.40	1.29	0.31	1.28	0.90	1.31	2.81	1.89	0.35	1.62	17.56
1985-86	5.35	1.55	1.61	0.51	2.39	2.33	0.50	1.34	2.92	1.83	2.09	0.81	23.23
1986-87	3.63	0.80	1.78	0.63	0.38	0.46	3.47	1.15	1.89	1.95	4.85	0.98	21.97
1987-88	0.81	0.12	0.91	1.18	0.98	1.03	0.77	1.36	3.60	1.98	1.07	0.13	13.94
1988-89	2.30	0.62	1.39	1.69	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69	23.39
MEAN	1.66	1.32	1.43	1.63	1.51	1.20	1.17	1.39	2.28	2.76	1.55	1.61	19.50

Mean precipitation for all crop years = 19.50

Table 6. Precipitation by day for crop year, September 1, 1988 through August 31, 1989. Northwestern Agricultural Research Center, Kalispell, MT.

DATE	SEPT. 1988	OCT. 1988	NOV. 1988	DEC. 1988	JAN. 1989	FEB. 1989	MAR. 1989	APR. 1989	MAY 1989	JUNE 1989	JULY 1989	AUG. 1989
1					0.05	0.08	0.08			0.13		
2			0.02				0.12		0.54		0.01	
3			0.19				0.30	T	0.66	0.02	T	
4			0.03					T	0.05			
5			T					0.19				
6			0.06	0.11	0.30		0.02	0.17				
7			0.12	0.45				0.06	0.15			
8					0.04				0.20			
9			0.08		0.35		0.11					0.12
10					0.30		0.36			0.47	T	
11	0.34		0.12							0.90	0.26	
12			T				0.08					
13				0.36	0.01	0.02				T	0.60	0.41
14			0.06	0.03		0.11	0.31				0.39	
15		0.05				0.02	0.04			0.27	T	0.30
16		0.20	0.01			0.39	0.03			0.23	0.28	
17		0.19	0.01		0.09	0.08	0.12		0.18		0.44	
18	0.70		0.12		0.08	0.19			0.20		0.02	
19	0.12	0.10	0.02	0.02	0.10	0.16	0.12					
20	0.46	0.02		0.08		0.06				T	0.02	
21			0.13	0.04						0.02		0.13
22			0.03	0.02	0.02	0.06	0.10	0.10				0.16
23			0.03	0.19								0.45
24				0.04				0.03	0.19			0.70
25	0.04		0.01		0.02		0.05		0.01	0.01	0.12	1.05
26	0.19		0.03			T	0.16	0.54	0.08			0.04
27	0.35	0.06				0.22	0.02					0.04
28	0.10		0.32	0.08		0.09	T		0.12		0.46	0.16
29				0.07					0.25			
30				0.20			0.27		0.07		0.10	
31		T			0.03							0.13
TOTAL	2.30	0.62	1.39	1.69	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69

Table 7. Frost free period at the Northwestern Agricultural Research Center from 1950 thru 1989.

YEAR	DATE LAST FREEZE	TEMPERATURE DEGREE F	DATE FIRST FREEZE	TEMPERATURE DEGREES F	FROST FREE SEASON
1950	June 10	32	Sept. 11	29	93
1951	June 1	29	Sept. 15	29	106
1952	June 14	32	Sept. 8	29	86
1953	May 23	32	Sept. 16	31	116
1954	May 29	31	Sept. 30	26	124
1955	May 25	28	Sept. 13	31	111
1956	May 3	26	Sept. 2	32	122
1957	May 23	30	Sept. 9	30	109
1958	May 14	31	Sept. 27	31	136
1959	June 11	32	Aug. 30	30	80
1960	June 18	32	Sept. 6	32	80
1961	May 6	32	Sept. 12	29	129
1962	May 30	32	Sept. 3	25	96
1963	May 22	28	Sept. 18	32	119
1964	May 25	26	Sept. 11	28	109
1965	June 7	30	Sept. 6	31	91
1966	May 18	26	Sept. 30	28	135
1967	May 26	28	Sept. 23	32	120
1968	May 20	32	Sept. 21	32	124
1969	June 13	28	Sept. 6	32	85
1970	May 11	32	Sept. 10	31	122
1971	July 7	32	Sept. 14	28	69
1972	May 4	32	Sept. 12	32	131
1973	May 22	31	Sept. 2	31	103
1974	May 18	31	Sept. 2	30	107
1975	May 25	32	Sept. 12	32	110
1976	May 21	30	Sept. 8	30	110
1977	May 16	29	Sept. 27	28	133
1978	May 23	31	Sept. 17	28	116
1979	May 30	31	Oct. 1	32	123
1980	June 4	32	Sept. 24	31	111
1981	May 5	28	Sept. 24	25	142
1982	May 30	31	Sept. 15	23	108
1983	May 15	31	Sept. 6	31	114
1984	June 2	32	Sept. 13	30	103
1985	May 13	26	Sept. 7	32	117
1986	May 16	31	Sept. 7	31	114
1987	May 22	28	Sept. 17	29	117
1988	May 3	30	Sept. 12	30	131
1989	May 21	32	Sept. 9	29	110
Mean for years	May 25	30	Sept. 13	30	112

Table 8. Temperature extremes at the Northwestern Agricultural Research Center, Kalispell, MT from 1950-1989.

YEAR	MINIMUM DATE	MINIMUM TEMPERATURE DEGREES F	MAXIMUM DATE	MAXIMUM TEMPERATURE DEGREES F
1950	Jan. 30	-40	Aug. 31	88
1951	Jan. 28	-25	Aug. 2	92
1952	Jan. 1	-14	Aug. 31	90
1953	Jan. 6	8	July 12	97
1954	Jan. 20	-32	July 6	90
1955	Mar. 5	-20	June 22	96
1956	Feb. 16	-25	July 22	90
1957	Jan. 26	-34	July 13	91
1958	Jan. 1	2	Aug. 11	94
1959	Nov. 16	-30	July 23	96
1960	Mar. 3	-32	July 19	98
1961	Jan. 2	0	Aug. 4	100
1962	Jan. 21	-32	Aug. 16	92
1963	Jan. 30	-24	Aug. 9	94
1964	Dec. 17	-28	July 8	91
1965	Mar. 24	-10	July 31	89
1966	Mar. 4	- 7	Aug. 2,25	91
1967	Jan. 24	2	Aug. 19	95
1968	Jan. 21	-23	July 7	94
1969	Jan. 25	-13	Aug. 24	97
1970	Jan. 15	-14	Aug. 21,25	92
1971	Jan. 12	- 8	Aug. 6, 9	96
1972	Jan. 28	-24	Aug. 9,10	92
1973	Jan. 11	-22	July 11	97
1974	Jan. 5	-18	June 16,20	93
1975	Jan. 12, Feb. 9	-16	July 12	96
1976	Feb. 5	- 4	July 27	90
1977	Dec. 31	-11	June 7	97
1978	Dec. 31	-31	July 16	91
1979	Jan. 1	-31	July 20	97
1980	Jan. 29	-20	July 23	92
1981	Feb. 21	-21	Aug. 26,27	97
1982	Feb. 9,10	-23	Aug. 8	91
1983	Dec. 25	-29	Aug. 8	97
1984	Jan. 18	-14	July 27	97
1985	Jan. 30	-24	July 9,11,23	94
1986	Nov. 10	- 8	May 30	93
1987	Jan. 16, Dec. 3	- 4	July 27	95
1988	Jan. 6	-17	July 22, Aug. 6	92
1989	Feb. 4, 5	-20	Aug. 1	96

Table 9. Summary of temperature records at the Northwestern Agricultural Research Center, January 1950 thru December 1989.

AVERAGE TEMPERATURE BY MONTH AND YEAR
DEGREES FAHRENHEIT

DATE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	MEAN
1950	4.2	25.6	31.2	41.9	49.7	57.0	64.0	62.5	53.8	45.9	31.5	29.5	41.4
1951	20.2	27.7	27.0	42.1	50.0	54.2	64.7	60.4	50.6	40.8	30.8	16.9	40.5
1952	18.0	26.6	29.3	45.8	52.4	56.7	61.8	62.8	56.0	45.5	30.4	27.6	42.7
1953	36.0	32.9	37.2	41.2	49.5	54.6	64.3	63.1	56.1	46.2	37.0	31.3	45.8
1954	21.1	31.2	29.6	40.8	52.5	54.9	63.4	60.1	52.9	41.5	38.8	28.8	43.0
1955	25.7	22.1	24.5	39.1	47.7	58.8	62.7	62.2	52.5	44.6	23.5	21.8	40.4
1956	23.3	20.9	31.5	44.2	54.0	59.0	64.8	62.0	55.2	44.1	30.9	28.5	43.2
1957	10.2	23.4	33.3	43.7	55.6	59.7	65.4	62.4	55.8	41.4	32.1	32.4	43.0
1958	29.1	30.4	32.2	43.6	59.6	62.3	65.2	67.9	55.5	44.6	32.8	28.2	46.0
1959	24.7	23.1	35.3	45.2	48.1	59.9	64.5	61.0	53.0	43.9	25.5	27.6	42.7
1960	19.4	25.2	32.3	44.3	50.6	59.6	68.8	60.6	55.0	45.2	34.4	24.9	43.4
1961	27.8	37.0	38.2	42.0	52.6	64.7	66.2	67.8	49.6	42.3	28.2	23.6	45.0
1962	17.4	25.7	30.9	47.2	51.5	58.6	62.1	62.1	54.7	44.7	38.0	32.5	43.8
1963	11.8	33.1	38.7	42.3	51.4	59.4	63.0	64.9	58.7	47.4	35.8	24.0	44.2
1964	28.5	28.3	30.6	42.8	51.1	58.7	64.3	58.9	51.2	43.7	33.7	22.1	42.8
1965	30.2	28.7	28.6	45.2	50.6	57.6	64.6	63.6	46.4	47.6	35.0	28.8	43.9
1966	26.3	27.7	34.5	42.9	54.3	56.0	64.5	61.7	59.3	43.4	33.4	30.2	44.5
1967	31.0	33.2	32.9	40.6	52.2	59.4	66.1	67.2	61.0	45.9	33.8	25.1	45.7
1968	23.3	32.8	41.2	42.0	49.8	59.0	64.6	61.3	53.8	42.9	33.4	19.9	43.7
1969	13.1	24.0	29.6	47.1	53.9	58.8	62.3	63.6	56.0	40.0	35.2	27.7	42.6
1970	21.9	29.9	32.8	40.2	53.2	62.0	64.8	62.6	48.7	40.1	31.3	26.2	42.8
1971	23.6	29.9	33.2	43.6	52.5	54.9	61.9	68.2	49.5	40.4	34.1	22.0	42.8
1972	17.0	27.3	38.5	40.6	51.9	59.3	61.5	65.9	50.2	40.3	33.7	19.9	42.2
1973	20.7	27.8	37.7	42.2	51.5	57.5	65.1	64.5	53.3	44.1	29.3	30.8	43.7
1974	21.0	32.3	33.6	42.7	48.0	61.5	64.8	61.6	52.8	43.6	34.8	30.1	43.9
1975	21.5	21.5	29.9	37.6	48.6	55.9	69.1	59.8	52.1	42.9	35.4	27.5	41.8
1976	27.7	29.9	31.0	43.4	51.9	54.5	63.4	61.3	55.2	42.4	33.1	28.6	43.5
1977	20.0	30.9	34.4	45.0	49.7	61.5	62.6	62.8	51.7	42.5	30.4	22.0	42.8
1978	21.6	26.1	34.3	43.7	48.1	59.1	63.4	60.3	53.7	43.7	27.2	18.8	41.7
1979	4.1	24.9	34.7	42.3	51.5	59.4	65.0	65.4	56.9	46.6	30.7	33.0	42.9
1980	16.3	29.0	32.6	47.1	54.8	56.9	63.5	58.6	54.1	45.3	35.8	32.2	43.9
1981	30.1	31.3	38.5	44.5	52.5	53.8	62.8	66.4	55.3	43.2	36.0	27.0	45.1
1982	21.6	24.5	37.5	39.4	49.8	59.8	61.1	63.0	53.4	41.0	29.1	25.9	42.2
1983	30.3	33.8	37.9	42.4	51.9	57.6	59.6	65.4	50.4	42.9	36.6	11.1	43.3
1984	27.6	32.4	38.3	42.2	48.7	56.4	65.3	64.6	49.5	40.0	32.6	20.6	43.2
1985	19.2	19.0	30.8	44.8	53.7	57.6	68.3	60.2	47.8	40.8	18.6	18.3	39.9
1986	25.4	25.6	40.6	43.8	53.7	63.9	59.9	66.1	50.2	43.0	30.3	24.9	44.0
1987	22.2	27.9	35.0	47.8	55.6	61.6	62.9	59.8	56.1	43.2	35.3	25.4	44.4
1988	20.5	30.3	37.8	45.7	51.4	60.9	63.7	63.9	53.8	47.5	36.3	23.3	44.6
1989	27.5	12.4	28.8	44.2	49.6	59.8	65.4	61.9	52.7	42.7	35.8	25.3	42.2
MEAN	22.0	27.7	33.7	43.2	51.6	58.6	64.0	63.0	53.4	43.4	32.5	25.6	43.2

Table 10. Summary of precipitation records at the Northwestern Agricultural Research Center, Kalispell, MT, January 1950 thru December 1989.

	Total Precipitation (inches) by Months and Years												
DATE	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL
1950	2.62	1.13	2.31	0.84	0.15	3.90	3.12	0.75	0.52	2.30	1.16	2.48	21.28
1951	0.94	1.29	0.62	2.32	3.77	2.26	1.03	2.86	1.49	5.62	1.01	3.31	26.52
1952	1.03	0.98	0.97	0.17	1.32	3.95	0.56	0.69	0.13	0.05	0.60	0.98	11.43
1953	1.84	1.14	0.98	2.07	2.00	3.31	T	1.62	0.71	0.03	0.87	1.30	15.87
1954	2.65	0.79	0.83	0.79	1.52	2.98	2.91	3.79	1.09	0.54	1.00	0.43	19.32
1955	1.00	1.31	0.44	0.82	1.18	1.86	3.08	--	1.64	1.89	1.97	2.38	17.57
1956	1.76	1.53	0.87	1.28	1.06	4.20	2.13	3.21	1.16	1.10	0.53	0.96	19.79
1957	1.47	1.14	0.75	1.22	1.75	2.51	0.52	0.78	0.10	1.59	0.96	1.76	14.55
1958	1.56	2.67	0.97	1.47	2.20	2.56	0.84	0.58	1.99	1.16	2.90	2.77	21.67
1959	1.95	1.33	0.75	1.62	4.10	1.75	T	0.91	4.22	3.36	4.32	0.34	24.65
1960	1.67	1.10	1.01	1.23	3.27	0.69	0.13	2.43	0.55	1.44	1.72	1.24	16.48
1961	0.65	1.46	1.96	2.26	4.02	1.45	0.76	0.64	3.40	1.22	1.77	2.09	21.68
1962	1.33	1.15	1.59	0.96	2.59	1.15	0.11	0.72	0.58	1.85	1.31	0.91	14.25
1963	1.69	1.21	0.85	1.07	0.57	5.00	1.44	2.10	1.46	0.75	0.95	1.70	18.79
1964	1.46	0.41	1.57	0.87	3.33	3.86	3.01	1.64	2.27	0.85	1.62	3.62	24.51
1965	2.25	0.64	0.24	2.55	0.81	2.30	1.15	4.74	1.72	0.21	1.31	0.55	18.47
1966	1.42	0.67	0.53	0.76	1.18	6.57	2.49	1.64	0.79	1.34	3.33	1.68	22.40
1967	1.50	0.62	1.27	0.99	1.30	2.53	0.02	0.01	0.91	1.88	0.62	1.16	12.81
1968	0.79	1.15	0.68	0.57	3.92	2.22	1.00	3.42	4.51	2.39	1.59	3.12	25.36
1969	3.05	0.75	0.69	1.39	1.19	5.21	0.70	0.09	1.54	1.90	0.31	1.14	17.96
1970	3.10	0.89	1.49	0.76	1.97	4.37	3.08	0.44	1.79	1.38	1.75	0.99	22.01
1971	1.84	0.77	0.69	0.58	2.45	4.42	1.31	1.11	0.94	0.87	1.70	1.62	18.30
1972	1.10	1.65	2.11	0.95	1.48	3.28	1.77	0.98	1.38	1.84	0.80	2.19	19.53
1973	0.52	0.56	0.70	0.45	1.13	2.14	0.01	0.63	1.37	1.41	2.95	1.94	13.81
1974	1.35	1.32	1.40	3.36	1.82	1.80	1.01	0.62	0.80	0.12	1.10	1.31	16.01
1975	1.56	1.08	1.50	1.27	1.50	1.40	1.08	4.26	1.18	2.96	0.85	1.39	20.03
1976	0.91	1.12	0.34	1.92	1.90	2.49	1.49	3.42	0.96	0.62	0.73	0.86	16.76
1977	0.83	0.71	1.40	0.41	2.90	0.52	3.60	1.50	2.84	0.56	1.62	4.10	20.99
1978	2.15	0.99	0.73	2.54	3.56	2.63	3.90	3.34	1.90	0.15	0.96	0.91	23.76
1979	1.70	1.45	0.82	2.33	2.67	1.23	0.40	1.79	1.03	1.75	0.50	1.03	16.70
1980	1.53	2.03	0.97	1.88	5.48	3.89	1.08	2.45	1.20	0.83	0.78	2.58	24.70
1981	1.81	1.85	2.17	1.75	3.86	4.70	1.17	0.96	0.77	0.56	1.49	1.91	23.00
1982	2.38	1.48	1.16	1.60	1.25	2.41	2.06	1.17	2.37	0.75	1.39	1.60	19.62
1983	0.93	0.85	1.71	2.41	1.20	2.96	3.66	1.16	1.70	1.13	1.96	2.57	22.24
1984	0.80	2.19	1.81	1.93	2.91	2.07	0.31	0.55	2.15	2.25	1.40	1.29	19.66
1985	0.31	1.28	0.90	1.31	2.81	1.89	0.35	1.62	5.35	1.55	1.61	0.51	19.49
1986	2.39	2.33	0.50	1.34	2.92	1.83	2.09	0.81	3.63	0.80	1.78	0.63	21.05
1987	0.38	0.46	3.47	1.15	1.89	1.95	4.85	0.98	0.81	0.12	0.91	1.18	18.15
1988	0.98	1.03	0.77	1.36	3.60	1.98	1.07	0.13	2.30	0.62	1.39	1.69	16.92
1989	1.39	1.48	2.29	1.09	2.70	2.05	2.70	3.69	1.50	2.29	3.75	1.92	26.85
MEAN	1.51	1.20	1.17	1.39	2.28	2.76	1.55	1.61	1.67	1.35	1.48	1.65	

CHEMICALS USED IN HERBICIDE STUDIES 1988-89, NWARC, KALISPELL,MT

Common name	Trade name	Chemical name	Company
Imazamethabenz (AC 222,293)	Assert	m- toluic acid, 6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-methyl ester and p-toluic acid, 2(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-methyl ester	Am. Cyanamide
Bromoxynil	Brominal /Buctril	3,5-dibromo-4-hydroxybenzonitrile	Un. Carbide Rhone Poulenc
Bromoxynil + MCPA	Bronate /Brominal+	3,5-dibromo-4-hydroxybenzonitrile + [(4-chloro-o-tolyl)oxy]acetic acid	Rhone Poulenc/ Un. Carbide
CGA 131036	Amber	N-(6-methoxy-4-methyl-1,3,5-triazin-2-yl aminocarbinyl-2-(2-chloroethoxy)bezene sulfonamide	Ciba-Giegy
Chlorsulfuruon	Glean	2-chloro-N[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesul fonamide	DuPont
Clopyralid	Stinger	3,6-dichloro-2-pyridinecarboxylic acid	Dow
Clopyralid + 2,4-D	Curtail	3,6-dichloro-2-pyridinecarboxylic acid + (2,4-dichlorophenoxy)acetic acid	Dow
Clopyralid + MCPA	Stinger	3,6-dichloro-2-pyridinecarboxylic acid [(4-chloro-o-tolyl)oxy]acetic acid	Dow
Dicamba	Banvel	3,6-dichloro-2-methoxybenzoic acid	
Diclofop-m	Hoelon	2-[4-(2,4-dichlorophenoxy)phenoxy pro-panoic acid	Hoechst Roussel
DPX-L 5300	Express	Methyl 2 [[[[N-(4-methoxy-6-methyl-1,3,5-triazin-2-yl) methylamino] carbonyl]amino]sulfonyl]benzoic acid	DuPont
DPX-R 9674	Harmony Extra	2:1 ratio of DPX-M6316 + DPX-L5300	DuPont
DPX-Y6202	Assure	2-[4-[(6-chloro-2-quinoxalinyl)oxy] phenoxyl]propionic acid ethyl ester	DuPont
EPTC	Eptam	S-ethyl dipropylthiocarbamate	Stauffer/ICI
Fenoxaprop	Puma	(+)-2-[4-[(6-chloro-2-benz-oxazoly)oxy] phenoxy]propanoic acid	Hoechst/ Roussel
Fenoxaprop	Tiller	Fenoxaprop ethyl, 2,4-Dester, and MCPA	Hoechst/

+2,4-D + MCPA		ester (see respective chemistries)	Roussel
Fluazifop	Fusilade	(R)-2-[4-[[5-(triflouromethyl)-2-pyridinyl] oxy]phenoxy]propanoic acid	ICI Am.
Glyphosate	Roundup	N-(phosphonomethyl) glycine	Monsanto
Haloxyfop	Verdict	2-[4-[(6-chloro-25-(triflouromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid	Dow
Hexazinone	Velpar	3-cyclohexyl-6-(dimethylamino)-1-methyl--1,3,5-triazine-2,4-(1H,3H)-dione	DuPont
HOE 6001	-----	No chemistry available	Hoechst/ Roussel
MCPA	MCPA	[(4-chloro-o-tolyl)oxyl]acetic acid	As available
Metribuzin	Sencor or Lexone	4-amino-6-tert-butyl-3-(methylthio)-as triazin-5(4H)one	Mobay DuPont
Picloram	Tordon	4-amino-3,5,6-trichloro-2-pyridnecarboxylic acid	Dow
Sethoxydim	Poast	2[(1-ethoxyimino)butyl]-5[(2-ethylthio)-propyl]-3-hydroxy-2-cyclohexen-1-one	BASF
Thiameturon (DPX-M6316)	Harmony	3-[[(4-methoxy-6-methyl-1,3,5-triaziin-2-yl)amino carbonyl]amino sulfonyl]-2-thiophenecarboxylic acid	Dupont
Triallate	Fargo	S-(2,3,3-trichloro-2-propenyl)bis(1-methyl ethyl)carbamothioate	Monsanto
Triallate + Trifluralin	Buckle	S-(2,3,3-trichloro-2-propenyl)bis(1-methyl ethyl)carbamothioate + 2,6-dinitro-N,N-dipropyl-4-(triflouoromethyl)benzene-amine	Monsanto
2,4-D	2,4-D	(2,4-dichlorophenoxy)acetic acid	Cenex
2,4-DB	2,4-DB	4-(2,4-dichlorophenoxy)butyric acid	Rhone Poulenc

PROJECT TITLE: Bedstraw Herbicide Study

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC - Kalispell, MT
Chemical cooperators

OBJECTIVE: Evalute Assert, Bronate and combinations of these herbicides for bedstraw control.

SUMMARY: Assert and Bronate alone, as well as in combination, provided very good control of bedstraw at each of the three application dates.

RESEARCH METHODS:

Plots were established in a field of Gallatin spring barley in a randomized complete with four replications. Treatments were applied either June 6, June 22, or June 28. Applications were made using a research-type, tractor mounted sprayer using 24.85 gpa, 8002 nozzles, and 32 psi.

Application data:	June 7	June 22	June 28
Air temp:	79 F	62 F	81 F
Soil temp:	74	69	74
Rel humid:	4 %	15%	4%
Wind (mph):	0-2	3-4	4-5
Cloud cover:	clear	overcast	clear
Soil moisture:	top/good	top/fair	top/dry
	sub/v.good	sub/good	sub/good
Crop stage:	3 lf	8 "	8-10 "
Bedstraw-	2-4 lf	seedling - 1"	1-2 "
Fanweed -	4-8 lvs	2-3 "	4 "
W. buck -	cotylydons	4-8 lvs	none

RESULTS:

It was an objective of this study to find if timing of herbicide applications is effective in the control of bedstraw. Bedstraw was prevalent in the initial stages of this test but was thinned out by the grain, and probably, non-conducive growing conditions.

Similar rates of Assert and Bronate alone, and in combinations, resulted in lower yields with the later application dates. The yield differences were significantly less than the check in the two later applications dates of Assert alone and the second application date of Bronate. It appears the later applications of Assert were more injurious than those of Bronate. Yield differences in the combination treatments did not vary greatly because of application dates.

Test weights were significantly less than the check for each treatment except for Assert and Bronate applied alone at the first application date. Height was significantly less for all Assert treatments except where Assert and Bronate were combined at the early application.

With out having the weed pressure from bedstraw through out the growing season it is impossible to pick the most effective application date. Even with the potential for crop injury with Assert, Bronate, or combination treatments later in the season, the proper timing for a herbcide treatment of this nature would be very beneficial. We hope to deter-

mine the exact effects of these treatments on grain yields and the most beneficial time of applications in further research. Table 1 and 2.

FUTURE PLANS:

The weed, Bedstraw, continues to encroach upon some fields in western Montana. It is a very difficult weed to control with the tools and herbicides we now have, therefore this study should continue in order to find a method to control this species.

Table 1. Agronomic data from Bedstraw Herbicide Study grown on Mahugh farm, Kalispell, MT in 1989.

Planting date: April 24,1989 Harvested: Sept. 14, 1989

Treat-ment	Appln. Date	Rate lb ai/A	Yield Bu/A	Test wt Lb/Bu	% Plump
Assert	6/7	.47	89.45	50.60	98.40
Assert	6/22	.47	80.78 b	49.80 b	96.70
Assert	6/28	.47	74.50 b	49.77 b	96.90
Bronate	6/7	.375	91.88	50.90	99.37
Bronate	6/22	.375	87.60	50.57 b	98.93
Bronate	6/28	.375	82.08 b	50.63 b	98.67
Assert	6/7	.47 +	88.33	50.47 b	95.40
+ Bronate		.375			
Assert	6/22	.47 +	86.33	50.00 b	97.53
+ Bronate		.375			
Assert	6/28	.47 +	85.70	49.57 b	96.87
+ Bronate		.375			
Check			92.40	51.03	99.30
OVERALL MEAN =			85.90	50.33	97.81
F-RATIO TRTS =			2.695*	19.81**	1.702
P-VALUE TRTS =			.0323	.0000	.1566
CV (SE/MEAN) =			3.886	.2280	1.039
LSD(0.05 by t)=			9.918	.3410	3.019

* or ** Indicates statistical significance at the .05 and .01 level respectively

b/ Value significantly less than the check

Table 2. Agronomic data from Bedstraw Herbicide Study grown on the Mahugh farm, Kalispell, MT in 1989.

Planting date: April 24,1989 Date harvested: Sept. 14, 1989

Treatment	Appln. Date	Rate lb ai/A	--- % Weed Control 7/19--- BEDSTRAW	WILD BUCK /1	HEIGHT 8/11 (Inches)
Assert	6/7	.47	95.67	100.0	30.84 b
Assert	6/22	.47	78.33	100.0	30.44 b
Assert	6/28	.47	91.67	100.0	30.44 b
Bronate	6/7	.375	78.33	99.67	31.23
Bronate	6/22	.375	98.33	100.0	30.97 b
Bronate	6/28	.375	98.67	100.0	31.10
Assert	6/7	.47 +	99.67	100.0	31.89
+ Bronate		.375			
Assert	6/22	.47 +	98.33	100.0	30.05 b
+ Bronate		.375			
Assert	6/28	.47 +	98.33	100.0	29.40 b
+ Bronate		.375			
Check			.0000	.0000	32.02
OVERALL MEAN =			83.73	93.30	30.84
F-RATIO TRTS =			25.15**	4.000**	4.711**
P-VALUE TRTS =			.0000	.0052	.0022
CV (SE/MEAN) =			7.272	11.29	1.194
LSD(0.05 by t)=			18.09	31.30	1.094

1/ % Weed control by ocular rating
Bedstraw = Galium aparine
Wild buckwheat = Polygonum convolulus

** Indicates statistical significance at the .01 level
b/ Values significantly less than the check at the .01 level.

PROJECT TITLE: Combination Herbicide Study

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT
Chemical Cooperators

OBJECTIVE: To determine the effectiveness of broadleaf and wild oat herbicides in combination for broad spectrum weed control.

SUMMARY: In high populations of broadleaf and wild oats several broadleaf herbicide treatments combined with Hoelon, Puma, Tiller and Assert provided excellent broad sprectrum weed control.

RESEARCH METHODS:

Herbicides were applied at the 1-3 leaf and 3-5 leaf stage of wild oats using a research-type tractor mounted sprayer. Plots were 10' X 12' with treatments being replicated four times in a randomized complete block design. A volume of 24.85 gpa was used with 8002 nozzles at 32 psi.

Planting data: Newana spring wheat was planted 4/21/89 at 60 lbs per acre using a International press-type drill with 7" spacing. Seed depth was 1 1/2" in a seedbed that had been first fall plowed, spring disced, cultivated and then packed. Previous crop was spring barley. A surfactant at .25% V/V was used with sulfonyl ureas except where combined with Hoelon.

Application data:	1-3 leaf stage	3-5 leaf stage
Date:	5/15/89	5/22/89
Air temp:	71 F	68 F
Soil temp:	66 F	66 F
Rel humid:	10%	11%
Wind (mph)	0-2 sw	0-3 ssw
Cloud cover:	clear	prtly cldy
Soil moisture:	top/good sub/v.good	top/fair sub/v.good
Weed stages:		
Wild oats	2 1/2 lf	4-5 leaf
Henbit	4-6 lvs	4-8 lvs
Fanweed	6-8 lvs	10-12 lvs
N. F. Catchfly	4 lvs	4-10 lvs
W. buckwheat	2 true lvs	2-4 lvs
Lambsquarter	4-6 lvs	4-10 lvs
Chickweed	seedling	6-10 lvs

RESULTS:

Broadleaf herbicide treatments alone were in most cases over run with wild oats resulting in very low yields. Sulfonylureas combined with Hoelon and Assert gave wild oat control below 90% and was less than 45% in the Hoelon plus Harmony Extra combination. All Puma and Tiller combinations gave excellent wild oat and broadleaf control. Puma and Tiller alone did not give as good wild oat control when combined with broad leaf herbicides suggesting a synergistic reaction. Broadleaf control was very good for most broadleaf herbicides tested and was even seen in wild oat treatments where plant competition thinned out broadleaf weeds. Yields varied from 102 bushel to 36.9 bushel/A and was related to, in most cases, the degree of wild oat control.

FUTURE PLANS:

Finding an economic level for weed control in small grains with the combination herbicides has been an ongoing project and will, no doubt, be continued at least another two years.

Table 1. Agronomic data from the Combination Herbicide Study. Percent weed control. Northwestern Agri. Res. Center, Kalispell, MT 1989. R-9
Date planted: April 21, 1989 Harvested: Sept. 12, 1989

#	Treatment	Rate (oz ai/A) unless marked #	% Wild Oat Control 7-11	7-24	% Stand Wheat
1.	Harmony Extra	.225	.0000	.0000	95.50
2.	Harmony Extra	.45	.0000	.0000	95.25
3.	Express + 2,4-D	.06 + 4.0	.0000	.0000	94.25
4.	Express + 2,4-D	.125 + 4.0	.0000	.0000	95.25
5.	Harmony Extra + 2,4-D	.225 + 4.0	.0000	.0000	92.75
6.	Harmony Extra + 2,4-D	.45 + 4.0	.0000	.0000	93.75
7.	Hoelon	1.0 #	96.75	90.75	95.75
8.	Hoelon + C.O.C.	.75 # + 1 pt	89.50	85.00	94.25
9.	Puma	.20 #	97.00	92.00	91.25
10.	Tiller	.66 #	92.25	82.50	95.25
11.	Assert + surf (.25%)	.45 #	99.50	90.50	94.25
12.	Harmony Extra + Hoelon	.225 + .75 #	83.00	44.50	95.00
13.	Harmony Extra + Hoelon	.45 # + .75 #	70.50	31.25	94.25
14.	Harmony Extra + Puma	.225 + .66 #	99.25	98.50	95.50
15.	Harmony Extra + Puma	.45 + .66 #	98.25	98.25	95.75
16.	Express + 2,4-D + Puma	.06 + 4.0 +.66#	100.0	100.0	96.25
17.	Express + 2,4-D + Puma	.125 + 4.0 +.66#	98.00	96.75	96.75
18.	Harmony Extra+2,4-D+Puma	.225 + 4.0 +.66#	99.75	99.00	96.50
19.	Tiller + Bromoxynil	.66 # + .25 #	98.25	96.00	96.00
20.	Tiller + Harmomy Extra	.66 # + .225	99.00	97.00	95.50
21.	Tiller + Tordon	.66 # + .023 #	97.50	96.00	95.75
22.	Tiller + Clopyralid	.66 # + .09 #	97.75	93.75	96.00
23.	Avenge + Surf(.25%)	.75 # + .25%	81.25	27.50	93.25
24.	Hoe 6001	.074 #	100.0	99.75	95.25
25.	Bromoxynil	.25 #	.0000	.0000	93.00
26.	Tordon	.023 #	.0000	.0000	95.25
27.	Clopyralid	.09 #	.0000	.0000	92.75
28.	Express	.125	.0000	.0000	94.00
29.	2,4-D	4.0	.0000	.0000	94.75
30.	Check	---	.0000	.0000	93.75
OVERALL MEAN =			56.58	50.63	94.76
P-VALUE TRTS =			.0000	.0000	.1507
CV (SE/MEAN) =			5.719	11.55	1.169
LSD(0.05 by t)=			9.096	16.44	3.114

HOE 6001	.57 lb ai/gal	Harmony Extra	75% DF	Express	75% DF
2,4-D	3.8 lb ai/gal	Hoelon	3 lb ai/gal	Puma(HOE7113)	.63 # ai/g
Assert	2.5 lb ai/gal	Avenge	2 lb ai/gal	Tordon	2 lb ai/gal
Clopyralid	3 lb ai/gal	Bromoxynil	4 lb ai/gal		

Tiller (HOE7125) 3.08 lb ai/A (.75# fenoxaprop, .58# 2,4-D, and 1.75# MCPA)
No surfactant added (label requirements) when Harmony is mixed with Hoelon.

Table 2. Agronomic data from the Combination Herbicide Study. Percent weed control. Northwestern Agri. Res. Center, Kalispell, MT 1989. R-9
Date planted: April 21, 1989 Harvested: Sept. 12, 1989

#	Treatment	Rate (oz ai/A) unless marked #	--- Percent Broadleaf Control 7-6-1989 --- FNWD	NFC	CKWD	BUCK	LMQTR	HNBT
1.	Harmony Extra	.225	100.0	100.0	100.0	95.00	100.0	99.25
2.	Harmony Extra	.45	100.0	100.0	100.0	94.00	98.75	100.0
3.	Express + 2,4-D	.06 + 4.0	100.0	99.50	100.0	67.50	100.0	96.75
4.	Express + 2,4-D	.125 + 4.0	100.0	98.50	100.0	98.75	99.75	95.00
5.	Harmony Extra + 2,4-D	.225 + 4.0	100.0	99.50	100.0	94.25	100.0	74.75
6.	Harmony Extra + 2,4-D	.45 + 4.0	100.0	100.0	100.0	99.25	100.0	100.0
7.	Hoelon	1.0 #	.0000	25.00	50.00	37.50	.0000	50.00
8.	Hoelon + C.O.C.	.75 # + 1 pt	12.50	43.75	50.00	25.00	15.00	67.50
9.	Puma	.20 #	.0000	25.00	62.50	52.50	25.00	50.00
10.	Tiller	.66 #	75.00	60.00	25.00	65.00	75.00	100.0
11.	Assert + surf (.25%)	.45 #	100.0	25.00	25.00	99.75	63.75	92.50
12.	Harmony Extra + Hoelon	.225 + .75 #	100.0	98.75	100.0	97.00	98.75	97.50
13.	Harmony Extra + Hoelon	.45 # + .75 #	100.0	100.0	100.0	100.0	100.0	100.0
14.	Harmony Extra + Puma	.225 + .66 #	100.0	100.0	100.0	75.00	100.0	93.25
15.	Harmony Extra + Puma	.45 + .66 #	100.0	100.0	100.0	100.0	100.0	98.25
16.	Express + 2,4-D + Puma	.06 + 4.0 +.66#	100.0	77.50	98.75	68.25	75.00	82.50
17.	Express + 2,4-D + Puma	.125 + 4.0 +.66#	100.0	94.50	100.0	93.00	100.0	92.00
18.	Harmony Extra+2,4-D+Puma	.225 + 4.0 +.66#	100.0	100.0	100.0	96.50	100.0	96.00
19.	Tiller + Bromoxynil	.66 # + .25 #	100.0	95.75	47.50	100.0	100.0	45.00
20.	Tiller + Harmony Extra	.66 # + .225	100.0	98.50	100.0	93.25	100.0	98.75
21.	Tiller + Tordon	.66 # + .023 #	100.0	90.50	41.25	99.00	100.0	73.25
22.	Tiller + Clopyralid	.66 # + .09 #	100.0	85.00	36.25	100.0	100.0	58.75
23.	Avenge + Surf(.25%)	.75 # + .25%	.0000	.0000	50.00	25.00	25.00	25.00
24.	Hoe 6001	.074 #	.0000	18.75	25.00	37.50	37.50	45.00
25.	Bromoxynil	.25 #	92.50	76.25	75.00	95.75	98.75	97.50
26.	Tordon	.023 #	25.00	46.25	47.50	70.00	50.00	55.00
27.	Clopyralid	.09 #	37.50	57.50	75.00	100.0	25.00	75.00
28.	Express	.125	100.0	100.0	100.0	99.00	100.0	99.50
29.	2,4-D	4.0	65.00	60.00	32.50	37.50	87.50	37.50
30.	Check	---	.0000	.0000	.0000	.0000	.0000	.0000
OVERALL MEAN =			73.58	72.52	71.38	77.18	75.82	76.52
P-VALUE TRTS =			.0000	.0000	.0000	.0000	.0000	.0000
CV (SE/MEAN) =			12.60	18.28	23.14	17.26	16.89	20.58
LSD(0.05 by t)=			26.06	37.27	46.43	37.45	35.99	44.26

Weed species: Wild oat (Avena fatua) from previous table.
HNBT = Henbit (Lamium amplexicauli),
FNWD = Fanweed (Thlaspi arvense),
NFC = Night flowering catchfly (Silene noctiflora),
BUCK = Wild buckwheat (Polygonum convolvulus),
LMQTR = Lambsquarter (Chenopodium album),
CKWD = Chickweed (Stellaria media)

Table 3. Yield data from the Combination Herbicide Study. Northwestern Agri. Res. Center, Kalispell, MT 1989. R-9
Date planted: April 21, 1989 Harvested: Sept. 12, 1989

#	Treatment	Rate (oz ai/A) unless marked #	Yield Bu/A	Test Wt Lbs/Bu	Height Inches
1.	Harmony Extra	.225	63.6	58.6	34.2
2.	Harmony Extra	.45	65.6a	58.4	32.7
3.	Express + 2,4-D	.06 + 4.0	53.3	57.3	32.7
4.	Express + 2,4-D	.125 + 4.0	52.9	57.4	33.4
5.	Harmony Extra + 2,4-D	.225 + 4.0	46.5	57.8	33.6
6.	Harmony Extra + 2,4-D	.45 + 4.0	57.9	58.7	33.1
7.	Hoelon	1.0 #	81.0a	57.8	34.3
8.	Hoelon + C.O.C.	.75 # + 1 pt	74.4a	58.1	34.4
9.	Puma	.20 #	67.7a	58.2	34.6
10.	Tiller	.66 #	77.7a	59.0	34.0
11.	Assert + surf (.25%)	.45 #	88.4a	58.9	34.4
12.	Harmony Extra + Hoelon	.225 + .75 #	72.9a	59.3	34.7
13.	Harmony Extra + Hoelon	.45 # + .75 #	70.0a	56.9	34.3
14.	Harmony Extra + Puma	.225 + .66 #	90.6a	59.3	33.6
15.	Harmony Extra + Puma	.45 + .66 #	95.8a	59.5	34.1
16.	Express + 2,4-D + Puma	.06 + 4.0 +.66#	89.7a	59.9	34.0
17.	Express + 2,4-D + Puma	.125 + 4.0 +.66#	90.7a	59.4	34.8
18.	Harmony Extra+2,4-D+Puma	.225 + 4.0 +.66#	102.6a	59.6	34.6
19.	Tiller + Bromoxynil	.66 # + .25 #	91.6a	59.7	34.6
20.	Tiller + Harmomy Extra	.66 # + .225	93.9a	59.7	34.6
21.	Tiller + Tordon	.66 # + .023 #	89.5a	59.4	33.9
22.	Tiller + Clopyralid	.66 # + .09 #	91.0a	59.7	33.7
23.	Avenge + Surf(.25%)	.75 # + .25%	73.7a	57.3	34.7
24.	Hoe 6001	.074 #	81.6a	59.3	34.6
25.	Bromoxynil	.25 #	65.3a	59.4	34.5
26.	Tordon	.023 #	71.1a	59.4	34.7
27.	Clopyralid	.09 #	51.6	58.0	33.8
28.	Express	.125	45.8	57.3	33.6
29.	2,4-D	4.0	65.4a	58.6	34.4
30.	Check	---	36.9	57.8	33.7
	OVERALL MEAN =		73.3	58.63	34.03
	P-VALUE TRTS =		.000	.0579	.9072
	CV (SE/MEAN) =		13.48	1.237	2.141
	LSD(0.05 by t)=		27.77	2.039	2.050

a/ Values significantly greater than the check at the .01 level of probability.

PROJECT TITLE: Curtail / Assert Plantback Study, Initial Year

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC - Kalispell, MT.

OBJECTIVE: To evaluate the residual effect of both Curtail and Assert to subsequent plantings of sensitive crops.

SUMMARY: This was the establishment year of this trial on spring barley. Both herbicides gave excellent broadleaf weed control and did not adversely effect the crop.

RESEARCH METHODS:

Herbicides were applied post emergence to Moravian spring barley using a tractor-mounted research-type sprayer in 24.85 gpa at 32 psi. Plots 10' X 24' were established in a solid seeded field with three replications in a randomized block design.

Planting data:

Moravian spring barley was planted on April 21, 1989 at 60#/A using an International press-type drill with 7" spacing. Seed was planted 1 1/2 inches in a seedbed that had been first fall plowed, spring disced, cultivated and then packed. The previous crop was spring barley.

Application data:

Date: 6/7/89 Air temp: 76 F Soil Temp: 70 F rel Humid: 25
Wind: 0-2 mph,ssw Cloud cover: clear
Soil: top/good sub/v.good Crop stage: tiller, 5 leaf
Weed stages: Fanweed (Thlaspi arvense) 6-10 lvs
Henbit (Lamium amplexicauli) 2 lf, seedlings
Silene (Silene noctiflora) 4-6 lvs

RESULTS:

Excellent broadleaf weed control was obtained with all treatments. Yield data, test weights, percent plumps, and height measurements were all similar and not adversely effected by any of the treatments. Table 1 and 2.

FUTURE PLANS:

This study was begun in 1989 and will continue at least two more years to determine the residual effect of these herbicides on future crops.

Table 1. Agronomic data from the Curtail/Assert Study grown on the Northwestern Agricultural Research Center, Kalispell, MT. in 1989. Field R4

Date planted: April 20, 1989 Date harvested: Sept. 12, 1989

Treatment	Prod/Acre or (ai/A)	Percent Weed Control 1/				
		Fanweed	Wild Buck	Chickweed	Henbit	N F C
Curtail	2 pt (.58#)	100.0	100.0	100.0	100.0	100.0
Curtail	2 2/3 pt (.79#)	100.0	100.0	96.67	98.33	100.0
Curtail M	1 3/4 pt (.6#)	100.0	100.0	100.0	95.67	100.0
Curtail M	2 1/3 pt (.8#)	100.0	100.0	99.00	100.0	100.0
Assert	1.2 pt (.375#)	100.0	100.0	90.00	100.0	100.0
Assert	1.5 pt (.47#)	100.0	100.0	91.67	100.0	95.00
Assert + Curtail	1.2 pt + 2 pt (.375#+.59#)	100.0	100.0	98.33	100.0	100.0
Assert + Curtail M	1.2 pt + 1 3/4 pt (.375#+.6#)	100.0	100.0	98.33	100.0	100.0
Glean + surf.	1/3 oz. (.25oz)	100.0	100.0	100.0	100.0	100.0
Check		.0000	.0000	.0000	.0000	.0000
OVERALL MEAN	=	90.00	90.00	87.40	89.40	89.50
F-RATIO TRTS	=	.0000	.0000	91.15	837.7	396.5
P-VALUE TRTS	=	.0000	.0000	.0000	.0000	.0000
CV (SE/MEAN)	=	.0000	.0000	3.704	1.215	1.767
LSD(0.05 by t)	=	.0000	.0000	9.620	3.228	4.698

1/ Percent weed control, ocular rating by percentage of control in comparison to check.

Fanweed = Thlaspi arvense Wild Buckwheat = Polygonum convolvulus
Chickweed = Stellaria media Henbit = Lamium ampleicauli
N F C = night flowering catchfly , Silene noctiflora)

Table 2. Agronomic data from the Curtail/Assert Study grown on the Northwestern Agricultural Research Center, Kalispell, MT. in 1989.

Date planted: April 20, 1989 Date harvested: Sept. 12, 1989

Treatment	Prod/Acre or (ai/A)	Yield Bu/A	Test Wt Lbs/Bu	Percent Plump	Height Inches
Curtail	2 pt (.58#)	72.3	49.07	97.07	37.3
Curtail	2 2/3 pt (.79#)	69.4	48.97	97.17	37.8
Curtail M	1 3/4 pt (.6#)	64.7	49.37	96.80	37.1
Curtail M	2 1/3 pt (.8#)	67.7	49.23	95.90	36.7
Assert	1.2 pt (.375#)	60.9	48.77	95.63	36.2
Assert	1.5 pt (.47#)	72.2	49.17	96.30	36.2
Assert + Curtail	1.2 pt + 2 pt (.375#+.59#)	66.3	49.17	97.07	35.8
Assert + Curtail	1.2 pt + 1 3/4 pt (.375#+.6#)	65.3	49.53	97.60	36.2
Glean + surf.f.	1/3 oz. (.25oz)	65.3	49.40	97.03	37.4
Check		66.8	48.87	96.03	36.7
OVERALL MEAN =		67.08	49.15	96.66	36.78
F-RATIO TRTS =		.7004	1.019	.4700	1.788
P-VALUE TRTS =		.7127	.4657	.8883	.1361
CV (SE/MEAN) =		6.214	.4899	.9785	1.252
LSD(0.05 by t)=		12.38	.7155	2.810	1.368

PROJECT TITLE: Resistant Weed Management Study

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist. NWARC - Kalispell
Chemical cooperators of Dow Chemical Company

OBJECTIVE: To evaluate the combination of various herbicides with sulfonylureas for preventing the development of resistant weed species.

SUMMARY:

All broadleaf herbicides alone and in the various combinations provided excellent control of wild buckwheat, fanweed, lambsquarter, nightflowering catchfly, and henbit. Yields, test weights, and plant heights were not reduced due to the treatments.

RESEARCH METHODS:

Herbicides were applied post emergence to Newana spring wheat using a tractor-mounted, research-type sprayer. Plots were 10' X 12 ' with plots being replicated four times in a randomized complete block design. A spray volume of 24.85 gpa was applied using 8002 nozzles at 32 psi.

Planting data:

Crop: Newana spring wheat seeded April 21, 1989 at 60#/A.
Seedbed preparation: Fall plow and disc, spring disc and cultivate. Brillion packer to complete seedbed
Previous crop: spring barley
Type of planting: Press-type drill, 7" spacing, seeding depth of 1 1/2"
Maintenance spray of .75# ai/A of Hoelon May 10, 1989
Surfactant: .25% V/V for trtmt #1-2, .125% V/V on all others

Application data:

Date: May 17, 1989 Air temp: 64 F Soil temp: 60 F
Rel Humid. 30% Wind 0-2 mph Cloud cover: clear
Soil moisture: topsoil: fair subsoil: very good
Crop and weed stages at application:
Wild buckwheat (Polygonum convolvulus) 6-8 lvs
Fanweed (Thlaspi arvense) 6-10 lvs
Lambsquarter (Chenopodium album) 4-6 lvs
Night flowering catchfly (Silene noctiflora) 4 lvs
Henbit (Lamium amplexicauli) 4-6 lvs

RESULTS:

Broadleaf weed control was excellent for all of the treatments tested as well as the combination of treatments (except for 2,4-D alone). No crop injury was observed on the spring wheat. Yields and test weights were not significantly reduced due to treatments. The 2,4-D treatments resulted in a significantly lower test weight while a high test weight that was significant was recorded in the Curtail plot (.44 lb ai/A). Table 1 and 2.

FUTURE PLANS:

The development of resistant species to herbicides is not a new problem. We plan to continue this study, if funds are available.

Table 1. Agronomic data from the Resistant Weed Management Study. Northwestern Agricultural Research Center, Kalispell, MT 1989. Field R-9

Date planted: April 21, 1989 Date harvested: September 11, 1989

#	Treatment	Rate ai/A	Percent Broadleaf Control 7-5-89 1/				
			BUCK	FNWD	LMQTR	NFC	HNBT
1.	Express	.125 oz	85.25	100.0	100.0	100.0	96.75
2.	Harmony Extra	.187 oz	94.25	100.0	100.0	99.50	100.0
3.	Banvel	.125 lb	95.75	93.50	100.0	97.50	97.75
4.	Curtail	.44 lb	98.75	98.75	100.0	94.25	91.25
5.	Bromoxynil	.375 lb	95.25	100.0	100.0	96.75	89.75
6.	2,4-D	.375 lb	.0000	25.00	12.50	25.00	.0000
7.	Express + Banvel	.125 oz + .125 lb	97.50	100.0	100.0	100.0	99.00
8.	Harmony Extra + Banvel	.187 oz + .125 lb	100.0	100.0	100.0	99.50	100.0
9.	Express + Curtail	.125 oz + .44 lb	99.00	100.0	100.0	99.50	96.00
10.	Harmony Extra + Curtail	.187 oz + .44 lb	100.0	100.0	100.0	100.0	97.50
11.	Express + Bromox	.125 oz + .375 lb	99.00	100.0	100.0	100.0	99.00
12.	Harmony Extra + Bromox	.187 oz + .375 lb	98.75	100.0	100.0	100.0	100.0
13.	Express + 2,4-D	.125 oz + .375 lb	88.75	100.0	97.75	98.75	98.25
14.	Harmony Extra + 2,4-D	.187 oz + .375 lb	95.25	100.0	98.00	100.0	80.25
15.	Bronate	.375 lb	99.50	100.0	100.0	100.0	94.50
16.	Check	----	.0000	.0000	.0000	.0000	.0000
	Mean		84.19	88.58	88.02	88.17	83.75
	F ratio		433.2**	22.45**	102.9**	22.54**	49.40**
	P-value		.0000	.0000	.0000	.0000	.0000
	C.V.		1.890	7.169	3.585	7.150	5.621
	L.S.D. (.05)		4.532	18.09	8.987	17.96	13.41

1/ Percent weed control by ocular rating. Number of weeds/sq ft in check follows weed common name: BUCK = wild buckwheat 1.5 (Polygonum convolvulus) FNWD = fanweed 7.5 (Thlaspi arvense) LMQTR = lambsquarter .4 (Chenopodium album) NFC = night flowering catchfly 1.0 (Silene noctiflora), HNBT = henbit 1.0 (Lamium amplexicauli)

Table 2. Agronomic data from the Resistant Weed Management Study. Northwestern Agricultural Research Center, Kalispell, MT 1989. Field R-9. Yield data.

Date planted: April 21, 1989 Date harvested: September 11, 1989

#	Treatment	Rate ai/A	Yield Bu/A	Test Wt. Lb/Bu	Height Inches
1.	Express	.125 oz	72.1	59.5	32.6
2.	Harmony Extra	.187 oz	72.1	59.7	32.4
3.	Banvel	.125 lb	74.7	59.9	32.6
4.	Curtail	.44 lb	69.5	60.1a	32.2
5.	Bromoxynil	.375 lb	77.4	59.8	32.8
6.	2,4-D	.375 lb	64.7	58.7b	32.8
7.	Express + Banvel	.125 oz + .125 lb	75.8	59.9	32.4
8.	Harmony Extra + Banvel	.187 oz + .125 lb	73.8	59.9	32.9
9.	Express + Curtail	.125 oz + .44 lb	72.3	59.7	32.4
10.	Harmony Extra + Curtail	.187 oz + .44 lb	68.8	59.9	32.4
11.	Express + Bromox	.125 oz + .375 lb	70.8	60.0	32.4
12.	Harmony Extra + Bromox	.187 oz + .375 lb	67.4	59.9	32.4
13.	Express + 2,4-D	.125 oz + .125 lb	73.3	59.4	32.3
14.	Harmony Extra + 2,4-D	.187 oz + .125 lb	67.5	59.8	32.0
15.	Bronate	.375 lb	70.3	59.6	32.4
16.	Check	----	61.6	59.4	32.4
		Mean	70.15	59.68	32.47
		F ratio	1.562	2.039*	.7458
		P-value	.1201	.0310	.7335
		C.V.	4.668	.3910	.7992
		L.S.D. (.05)	9.405	.6647	.7390

Uniform application of .75 lb ai/A of Hoelon on June 1, 1989

PROJECT TITLE: Evaluation of Buckle, Fargo and Hoelon for pigeongrass control.

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT.
Monsanto Chemical Co.

OBJECTIVE: To evaluate the performance of Buckle with Fargo for PPI herbicide action against pigeongrass with a Hoelon comparison used as POST standard.

SUMMARY: Yield, test weight, % plump, and height were not significantly reduced by Buckle ,Fargo, or Hoelon treatments. All treatments provided excellant control of pigeongrass.

RESEARCH METHODS:

Prior to planting both Buckle and Fargo treatments were applied to the test area and preplant incorporated. Herbicides were applied using a tractor-mounted research-type sprayer at 24.85 gpa with 8002 nozzles at 32 psi. Herbicides were incorporated with a cultivator with 7' sweeps and harrow. Plots were 10'X 20' with three replications. Hoelon was applied post emergence to barley in the four leaf stage. A Hege 125B plot combine was used to harvest the experiment.

Planting data:

Crop was Gallatin spring barley planted at 50#/A using a press type drill with 7" spacing to 1 1/2 inches depth. Seedbed was prepared by fall plowing, spring disc followed by a vibrashank cultivator prior to being culti-packed. Maintenence spray: Buctril at .375 ai/A

Application data:	PPI	Post
Date:	5/5/89	6/2/89
Air temp:	76	60
Soil temp:	63	57
Rel Humid:	15	37
Wind (mph)	3 ssw	0 ssw
Cloud cover:	clear	prtly cldy
Soil moisture:	top/dry sub/good	top/good sub/v.good
Crop stage:	N/A	4 leaf barley
Weed stages	N/A	Pigeongrass 2 leaf (Setaria viridis) Broadleaves seedling (various species)

RESULTS:

No injurious effects were detected on Gallatin spring barley with the application of Buckle, Fargo and Hoelon for weed control. There were no statistical differences in the parameters measured. Pigeongrass control was 93% or better for each of the herbicides tested. Although percent stand was less in the Buckle plots no effects on yield were found. Table 1.

FUTURE PLANS:

At this writing, there are no future plans.

Table 1. Agronomic data from the Buckle Herbicide Trial. Northwestern Agricultural Research Center, Kalispell, MT 1989.
Date planted: May 8, 1989 Date harvested: Sept. 5, 1989

Treatment	Appln.	Rate lb ai/A	Yield Bu/A	Test Wt. Lb/Bu	% Plump	Height Inches
Buckle	PPI	1.0	21.96	50.00	94.13	19.03
Buckle	PPI	1.25	28.48	49.70	94.53	19.57
Fargo	PPI	1.0	29.53	50.73	92.17	19.53
Fargo	PPI	1.25	29.80	49.57	94.70	19.43
Hoelon	Post	.75	25.15	50.03	94.90	19.43
Check	---	---	28.98	50.30	95.40	19.57
OVERALL MEAN =			27.33	50.06	94.31	19.43
F-RATIO TRTS =			1.939	1.813	.4062	.1521
P-VALUE TRTS =			.1694	.1935	.8589	.9842
CV (SE/MEAN) =			8.188	.6253	1.877	2.674
LSD(0.05 by t)=			7.05	.9863	5.578	1.637

Table 2. Agronomic data from the Buckle Herbicide Trial. Northwestern Agricultural Research Center, Kalispell, MT 1989.
Date planted: May 8, 1989 Date harvested: Sept. 5, 1989

Treatment	Appln.	Rate lb ai/A	PIGEON /sq ft 6/12	PIGEON /sq ft 7/28	Percent PIGR Control	Percent Injury	Stand
Buckle	PPI	1.0	6.4	4.4	98.33	.3333	91.67
Buckle	PPI	1.25	1.9	1.9	94.00	.0000	91.67
Fargo	PPI	1.0	2.5	3.2	93.33	3.333	98.33
Fargo	PPI	1.25	2.4	3.0	95.00	.0000	95.00
Hoelon	Post	.75	1.9	1.9	100.0	.0000	96.67
Check	---	---	4.4	4.8	.0000	.0000	98.33
OVERALL MEAN =			3.24	3.206	80.11	.6111	95.28
F-RATIO TRTS =			1.11	2.143	164.4**	.9417	2.020
P-VALUE TRTS =			0.42	.1371	.0000	.5070	.1557
CV (SE/MEAN) =			53.3	25.92	3.829	226.0	2.258
LSD(0.05 by t)=			5.45	2.618	9.665	4.352	6.780

Table 1. Agronomic data from the Poast Herbicide Study on Alfalfa grown on the Northwestern Agricultural Research Center, Kalispell, MT

#	Treatment	Rate lb ai/A	% Control Setaria	% Injury	% Stand	HT(CM) 7/24
1.	Check	----	.0000	.0000	100.0	68.67
2.	Poast + O.C.	.2 + 1 qt	100.0	.0000	100.0	67.00
3.	Poast + O.C.	.3 + 1 qt	100.0	.0000	100.0	67.00
4.	Poast + O.C.	.4 + 1 qt	100.0	.0000	100.0	66.00
5.	Poast + Dash	.2 + 1 qt	100.0	.0000	100.0	66.67
6.	Poast + Dash	.3 + 1 qt	100.0	.0000	100.0	67.00
7.	Poast + Dash	.4 + 1 qt	100.0	.0000	100.0	69.33
	OVERALL MEAN =		85.71	.0000	100.0	67.38
	F-RATIO TRTS =		.0000	.0000	.0000	.5142
	P-VALUE TRTS =		.0000	.0000	.0000	.8075
	CV (SE/MEAN) =		.0000	.0000	.0000	2.437
	LSD(0.05 by t)=		.0000	.0000	.0000	5.059

Table 2. Agronomic data from the Poast Herbicide Study on Alfalfa grown on the Northwestern Agricultural Research Center, Kalispell, MT

FIRST HARVEST DATA

#	Treatment	Rate lb ai/A	Percent Composition 1/ BRDLF	GRSS	ALF	Tons/Acre HAY	ALF
1.	Check	----	.01	3.64	96.35	1.65	1.58
2.	Poast + O.C.	.2 + 1 qt	.39	.01	99.61	1.68	1.67
3.	Poast + O.C.	.3 + 1 qt	.19	.00	99.81	1.69	1.68
4.	Poast + O.C.	.4 + 1 qt	.34	.00	99.66	1.67	1.66
5.	Poast + Dash	.2 + 1 qt	.11	.00	99.89	1.59	1.59
6.	Poast + Dash	.3 + 1 qt	.08	.00	99.92	1.77	1.77
7.	Poast + Dash	.4 + 1 qt	.13	.00	99.87	1.81	1.80
	OVERALL MEAN =		.177	.521	99.30	1.695	1.682
	F-RATIO TRTS =		1.002	3.998*	3.835*	.5111	.6473
	P-VALUE TRTS =		.4750	.0174	.0202	.8097	.7109
	CV (SE/MEAN) =		78.11	132.0	.6712	6.257	6.233
	LSD(0.05 by t)=		.4275	2.119	2.054	.3268	.3230

1/ Percent composition determined by hand separation of species. Green weight of those species in regards to total weight from subsample determines percent composition.

Table 3. Agronomic data from the Poast Herbicide Study on Alfalfa grown on the Northwestern Agricultural Research Center, Kalispell, MT

SECOND HARVEST DATA

#	Treatment	Rate lb ai/A	Percent Composition 1/ BRDLF	GRSS	ALF	Tons/Acre HAY	ALF
1.	Check	----	0.0	0.0	100	1.44	1.44
2.	Poast + O.C.	.2 + 1 qt	0.0	0.0	100	1.56	1.56
3.	Poast + O.C.	.3 + 1 qt	0.0	0.0	100	1.41	1.41
4.	Poast + O.C.	.4 + 1 qt	0.0	0.0	100	1.52	1.52
5.	Poast + Dash	.2 + 1 qt	0.0	0.0	100	1.39	1.39
6.	Poast + Dash	.3 + 1 qt	0.0	1.3	98.7	1.43	1.42
7.	Poast + Dash	.4 + 1 qt	.10	0.0	99.9	1.50	1.50
	OVERALL MEAN =		.0124	.181	99.81	1.464	1.462
	F-RATIO TRTS =		1.000	1.00	.9664	.7371	.7414
	P-VALUE TRTS =		.4761	.476	.4958	.6462	.6431
	CV (SE/MEAN) =		264.6	264.6	.4848	4.905	5.033
	LSD(0.05 by t)=		.1009	1.479	1.491	.2213	.2267

1/ Percent composition determined by hand separation of species. Green weight of those species in regards to total weight from subsample determines percent composition.

PROJECT TITLE: Amber Plantback Study

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader- Vern R. Stewart, Todd K. Keener - Research Specialists, NWARC, Kalispell, MT

OBJECTIVE: To evaluate the effect of Amber residue on sensitive crops used in rotations of small grains and legumes.

SUMMARY: Alfalfa, lentils, and barley were seeded to areas with Amber residue. Lentils and alfalfa were sensitive to higher rates of Amber and Glean applied the previous spring.

RESEARCH METHODS:

Herbicides were applied the previous fall and spring to an area which was maintained through the winter and prepared for seeding in the spring to indicator crops for detection of chemical residue. The area was shallow disced in the fall of 1988 as well as in the spring of 1989. A brillion soil packer was used to prepare the seedbed. Alfalfa (Arrow at 10 #/A), lentils (Chilean at 50 #/A), and barley (Gallatin 60 #/A) were planted using a Research Plot seeder. Notes and observation were made throuhgout the season. Alfalfa biomass yields were obtained using an Almaco plot harvester, the barley yields by a Hege 125B combine, and lentil yields by hand. The area was kept weed free throuhgout the season by use of Poast, Hoelon, Bronate where needed, and by hand weeding.

RESULTS:

Barley replanted into Amber herbicide residues did not indicate any chemical injury of the components measured. Biomass data showed both alfalfa and lentils were injured by Glean applied in the previous fall and spring, as well as high rates of Amber in the spring. This pattern proved true through out the readings in injury, vigor, percent stand, and height. The data shows that Amber was more injurious with the previous spring application and that Glean was more injurious at the 20 gram/hectare rate than any other treatment. Table 1-11.

FUTURE PLANS:

Tested area will be planted to susceptible crops one more year to determine if there is still residue of the herbicides Amber and Glean, in the soil.

Agronomic data from the Amber Plantback Study conducted on the Northwestern Agricultural Research Center in Kalispell, MT in 1989.

Table 1. YIELD

Treatment	Appln/Rate	B A R L E Y 9/11 Yield Bu/A	Test Wt Lbs/Bu	% Plump
Amber	Fall/7.5 gm	68.9	48.55	90.82
Amber	Fall/10 gm	81.9	49.55	93.53
Amber	Fall/20 gm	90.3	49.30	94.22
Amber	Fall/30 gm	76.7	49.02	93.43
Glean	Fall/20 gm	75.4	48.85	92.30
Amber	Sprg/7.5 gm	75.9	49.02	92.13
Amber	Sprg/10 gm	78.0	49.17	91.93
Amber	Sprg/20 gm	83.8	48.77	93.50
Amber	Sprg/30 gm	77.3	48.75	92.40
Glean	Sprg/20 gm	82.8	48.77	91.23
Check	----------	73.4	49.10	91.80
OVERALL MEAN =		78.5	48.99	92.48
F-RATIO TRTS =		1.561 NS	1.303 NS	1.546 NS
P-VALUE TRTS =		.1618	.2704	.1668
CV (SE/MEAN) =		5.906	.5126	.9253
LSD(0.05 by t)=		13.40	.7253	2.471

Table 2. Biomass measurements (Kg/32 sq ft)

Treatment	Appln/Rate	Alfalfa 8/2	Alfalfa 9/26	Lentil 8/7
Amber	Fall/7.5 gm	4.963	5.465	5.253
Amber	Fall/10 gm	5.613	6.783	5.310
Amber	Fall/20 gm	5.962	8.368	5.508
Amber	Fall/30 gm	3.775	5.950	3.940
Glean	Fall/20 gm	2.300 b	4.015 b	3.090 b
Amber	Sprg/7.5 gm	5.250	6.582	5.358
Amber	Sprg/10 gm	4.700	4.750	3.978
Amber	Sprg/20 gm	2.200 b	4.582	3.392
Amber	Sprg/30 gm	.4625 b	1.648 b	2.633 b
Glean	Sprg/20 gm	1.712 b	2.382 b	2.973 b
Check	----------	5.325	6.957	4.818
OVERALL MEAN =		3.842	5.226	4.205
F-RATIO TRTS =		10.40	7.613	4.205
P-VALUE TRTS =		.0000**	.0000**	.0008**
CV (SE/MEAN) =		15.07	13.99	12.56
LSD(0.05 by t)=		1.672	2.112	1.526

Table 3. CROP INJURY May 31, 1989 1/

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	.0000	.0000	.0000
Amber	Fall/10 gm	.0000	.0000	.0000
Amber	Fall/20 gm	.0000	.3750	.0000
Amber	Fall/30 gm	.0000	.5000	.1250
Glean	Fall/20 gm	.0000	1.000 a	.8750 a
Amber	Sprg/7.5 gm	.0000	.0000	.0000
Amber	Sprg/10 gm	.0000	.0000	.1250
Amber	Sprg/20 gm	.0000	.1250	.1250
Amber	Sprg/30 gm	.0000	.5000	.7500 a
Glean	Sprg/20 gm	.0000	.7500 a	.7500 a
Check	----------	.0000	.0000	.0000
OVERALL MEAN =		.0000	.2955	.2500
F-RATIO TRTS =		.0000	3.852*	2.946**
P-VALUE TRTS =		.0000	.0016	.0092
CV (SE/MEAN) =		.0000	61.18	82.39
LSD(0.05 by t)=		.0000	.5221	.5949

Table 4. CROP INJURY July 19, 1989 1/

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	.0000	.0000	.0000
Amber	Fall/10 gm	.0000	.2500	.1250
Amber	Fall/20 gm	.0000	.2500	.0000
Amber	Fall/30 gm	.3750	1.500	1.250
Glean	Fall/20 gm	1.500	2.750 a	2.000
Amber	Sprg/7.5 gm	.0000	.1250	.0000
Amber	Sprg/10 gm	.1250	.8750	.1250
Amber	Sprg/20 gm	1.500	4.000 a	3.250 a
Amber	Sprg/30 gm	2.250	4.000 a	7.200 a
Glean	Sprg/20 gm	1.500	4.975 a	6.725 a
Check	---------	.0000	.0000	.0000
OVERALL MEAN =		.6591	1.702	1.880
F-RATIO TRTS =		1.816 NS	5.061**	6.941**
P-VALUE TRTS =		.0956	.0002	.0000
CV (SE/MEAN) =		95.47	49.27	55.07
LSD(0.05 by t)=		1.817	2.422	2.989

* Indicates statisitcal significance at the .05 level
** Indicates statistical significance at the .01 level
a/ Values significantly greater than the check at the .01 or .05 level
b/ Values significantly less than the check at the .01 or .05 level

Table 5. PERCENT STAND May 31, 1989

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	100.0	100.0	100.0
Amber	Fall/10 gm	100.0	100.0	100.0
Amber	Fall/20 gm	100.0	95.00	100.0
Amber	Fall/30 gm	100.0	92.50	93.75
Glean	Fall/20 gm	100.0	91.25	85.00 b
Amber	Sprg/7.5 gm	100.0	100.0	100.0
Amber	Sprg/10 gm	100.0	98.75	97.50
Amber	Sprg/20 gm	100.0	98.75	97.50
Amber	Sprg/30 gm	100.0	93.75	96.25
Glean	Sprg/20 gm	100.0	91.00	87.50 b
Check	----------	100.0	100.0	100.0
OVERALL MEAN =		100.0	96.45	96.14
F-RATIO TRTS =		.0000 NS	1.860 NS	5.864 **
P-VALUE TRTS =		.0000	.0872	.0001
CV (SE/MEAN) =		.0000	2.872	2.284
LSD(0.05 by t)=		.0000	8.001	6.341

Table 6. PERCENT STAND July 19, 1989

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	100.0	100.0	100.0
Amber	Fall/10 gm	99.25	97.50	99.00
Amber	Fall/20 gm	98.25	100.0	98.75
Amber	Fall/30 gm	94.25	90.25	78.75
Glean	Fall/20 gm	84.25	67.50 b	71.25 b
Amber	Sprg/7.5 gm	100.0	98.75	98.75
Amber	Sprg/10 gm	96.75	95.50	94.00
Amber	Sprg/20 gm	87.50	50.00 b	42.50 b
Amber	Sprg/30 gm	73.50	50.00 b	30.50 b
Glean	Sprg/20 gm	88.25	42.50 b	30.75 b
Check	----------	100.0	100.0	100.0
OVERALL MEAN =		92.91	81.09	76.75
F-RATIO TRTS =		1.748	6.101**	8.495**
P-VALUE TRTS =		.1101	.0000	.0000
CV (SE/MEAN) =		6.997	11.76	12.88
LSD(0.05 by t)=		18.78	27.55	28.56

Table 9. HEIGHT (INCHES) June 16, 1989

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	6.375	4.250	2.750 b
Amber	Fall/10 gm	7.125	4.875	3.750
Amber	Fall/20 gm	6.750	4.250	3.125
Amber	Fall/30 gm	6.375	3.625 b	2.125 b
Glean	Fall/20 gm	6.250	3.450 b	1.125 b
Amber	Sprg/7.5 gm	6.750	4.825	3.000
Amber	Sprg/10 gm	6.625	4.250	1.825 b
Amber	Sprg/20 gm	6.625	2.700 b	.7750 b
Amber	Sprg/30 gm	6.000	2.500 b	.6500 b
Glean	Sprg/20 gm	6.500	2.625 b	1.200 b
Check	----------	6.875	4.875	3.750
OVERALL MEAN =		6.568	3.839	2.189
F-RATIO TRTS =		1.053 NS	13.79**	11.38**
P-VALUE TRTS =		.4286	.0000	.0000
CV (SE/MEAN) =		4.645	6.426	15.64
LSD(0.05 by t)=		.8812	.7124	.9889

Table 10. HEIGHT (INCHES) July 21, 1989

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	30.1	14.2	20.7
Amber	Fall/10 gm	32.4	15.0	21.3
Amber	Fall/20 gm	33.0	15.2	22.1
Amber	Fall/30 gm	31.6	14.2	18.2
Glean	Fall/20 gm	30.2	13.1	12.6 b
Amber	Sprg/7.5 gm	32.2	14.6	20.1
Amber	Sprg/10 gm	31.9	15.2	19.8
Amber	Sprg/20 gm	31.5	11.6	14.2 b
Amber	Sprg/30 gm	31.0	9.4 b	1.5 b
Glean	Sprg/20 gm	32.2	8.7 b	7.9 b
Check	----------	31.9	14.8	22.0
OVERALL MEAN =		31.60	13.20	16.40
F-RATIO TRTS =		1.728	3.406**	10.41**
P-VALUE TRTS =		.1147	.0037	.0000
CV (SE/MEAN) =		2.126	9.622	12.66
LSD(0.05 by t)=		1.942	3.678	5.990

Table 11. PLANTS PER FOOT OF ROW (June 12, 1989)

Treatment	Appln/Rate	Barley	Lentil	Alfalfa
Amber	Fall/7.5 gm	5.900	3.925	7.425
Amber	Fall/10 gm	6.175	4.975	8.500
Amber	Fall/20 gm	5.650	4.525	9.175
Amber	Fall/30 gm	5.525	4.325	6.000
Glean	Fall/20 gm	5.425	4.400	5.575
Amber	Sprg/7.5 gm	6.350	4.850	6.675
Amber	Sprg/10 gm	6.150	5.325	7.750
Amber	Sprg/20 gm	7.400	4.800	7.575
Amber	Sprg/30 gm	5.250	4.500	6.100
Glean	Sprg/20 gm	6.500	4.075	6.750
Check	----------	6.325	5.250	8.100
OVERALL MEAN =		6.059	4.632	7.239
F-RATIO TRTS =		1.723 NS	1.307 NS	1.397 NS
P-VALUE TRTS =		.1161	.2685	.2249
CV (SE/MEAN) =		7.653	8.536	13.14
LSD(0.05 by t)=		1.339	1.142	2.748

* Indicates values significantly greater then the check (.05 level)
** Indicates values significantly greater than the check (.01 level)
a/ Values significantly greater than the check
b/ Values significantly less than the check

1/ Crop Injury ratings: rated 5/13/89 and 7/19/89 on 0-10 scale where "0" indicates no injury and " 10 " indicates plants dead due to chemical phytotoxicity.

2/ Vigor ratings: rated 6/16/89 and 7/19/89 on 0-10 scale where "10" indicates normal healthy plants and "0" indicates plants dead due to chemical injury.

Varieties grown: Gallatin spring barley, Chilean lentils, and Arrow alfalfa. Seeded may 8, 1989.

PROJECT TITLE: Glyphosate Products Evaluation and Time of Application on Leafy Spurge

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT.

OBJECTIVE: Evaluation of glyphosate products for leafy spure control at flowering and seed set.

SUMMARY: In testing several combinations of glyphosate (commercial and laboratory formulations) with 2,4-D, or dicamba it was observed that the later applications of all these combinations performed better than the " at flowering applications " and were very effective in the burndown of leafy spurge.

RESEARCH METHODS:

Research plots were established in a newly seeded spring barley field that had a moderate infestation of leafy spurge. Treatments were applied using a research-type, tractor-mounted sprayer in 24.85 gpa, with 8002 nozzles at 32 psi. Plots were 10' X 15', replicated twice.

RESULTS:

Of the six " at flower " treatments applied to leafy spurge the commercial formulations appeared to be more effective at initial burndown and in flower suppression. The degree of burn for flower applications held through the end of summer but regrew to previous populations by early October. A standard treatment of Tordon + 2,4-D was applied and did and excellent job in initial burn and long range control. Fallowmaster was weaker in the degree of burndown when compared to the commercial formulations and was not quite equal to the moderately effective laboratory combinations of glyphosate and 2,4-D or dicamba.

The " at seeding " applications appeared to be more effective in initial degree of burndown and flower suppression. Here also the Fallowmaster and glyphosate + dicamba combination proved noticeably less effective than the commercial formulations, or even Glyphosate + 2,4-D. Ratings for one year after application will reveal the long term suppression of leafy spruge for these treatments.

A sequential application was made to the first " at flowering " treatments to suppress regrowth of spurge.

Table 1. Agrononic from the Landmaster II and Fallow Master on Leafy Spurge Study conducted on the Northwestern Agricultural Research Center in Kalispell, MT in 1989

At Flower Applications

#	Treatment	Rate lb ai or ae/A	July 11, 1989 Burn	July 11, 1989 -Flow	July 24,1989 Burn	July 24,1989 %Regro	Oct. 11, 1989 %Regro	Oct. 11, 1989 Plnt
1.	Untreated	---	0	0	0	100	60	NP
2.	Landmaster II	.94	8.5	3.5	9.5	33	100	NP/OP
3.	Landmaster BW	1.36	8.3	3.0	9.7	25	100	NP/OP
4.	Fallow Master	.73	7.8	1.5	6.8	65	100	NP/OP
5.	Roundup + 2,4-D	.38 + .5	7.5	1.5	9.4	40	100	NP/OP
6.	Roundup + dicamba	.38 + .17	7.5	2.0	8.5	25	100	NP/OP
7.	Tordon + 2,4-D	.5 + 1.0	9.1	4.0	9.9	13	0	None

Rating scales and explanations:

July 11, 1989 ratings. Plants in full bloom, 12-18" tall

Burn = Degree of burndown form chemical application;

10 = plants completely brown and dead
7 = both green and brown color
5 = curled plants w/ green color, very little brown
3 = slight curl, still all green
0 = no difference from check plants

- Flow = Infloresence suspression.

4 = stopped completely
1 = slightly suppressed
0 = no suspression

July 24, 1989 ratings. Plants blooming ,14-20" tall

Burn = Degree of burndown form chemical application
Same rating scale as previous date
% Regro = Percentage of plant regrowth from old stand

Oct. 11, 1989.

% Regro = Percentage of plant regrowth from old stand
Plnt = Plant source: NP = new plants, OP = old plants

Table 1. (Cont'd) Agrononic from the Landmaster II and Fallow Master on Leafy Spurge Study conducted on the Northwestern Agricultural Research Center in Kalispell, MT in 1989

At Seeding Application

#	Treatment	Rate lb ai or ae/A	Sept 22, 1989 Burn	October 11, 1989 Burn	- Flowr
8.	Landmaster II	.94	9.8	10.0	4.0
9.	Landmaster BW	1.36	10	10.0	4.0
10.	Fallow Master	.73	6.3	6.3	2.2
11.	Roundup + 2,4-D	.38 + .5	9.9	10.0	4.0
12.	Roundup + dicamba	.38 + .17	6.3	8.0	3.3

Rating scales and explanations:

September 22, 1989 ratings.
Burn = Degree of burndown form chemical application
Burndown in Landmaster II, BW, and Roundup + 2,4-D plots was excellant and complete.
Fallowmaster and Roundup + Banvel gave only partial control.

October 11, 1989 ratings.
Burn = Degree of burndown form chemical application

10 = plants brown and dead
7 = both green and brown color
5 = curled plants w/ green color, very little brown
3 = slight curl, still all green
0 = no difference from check plants

- Flowr = Infloresence suspression.

4 = stopped completely
1 = slightly suppressed
0 = no suspression

Applications at 1) flowering before seed set : June 23, 1989
2) late summer, seed set : August 29, 1989
3) sequential appln to 1st appln stage to control regrowth: October 4, 1989

PROJECT TITLE: Herbicide Evaluations on Mint.

YEAR/PROJECT: 1989/754

PROJECT PERSONNEL: Les Toavs, Evans farm, Kalispell, MT
Henry Ficken, Somers, MT
Mint Industry Research Committee
N.W. Agricultural Research Center -
Vern Stewart and Todd Keener

OJECTIVES: To collect efficacy data in regards to grass herbicides in mint to support data base for registration of sethoxydim (Poast) and fluazifop-butyl (Fusilade).

Evaluation of clopyralid at varying rates to determine efficacy, crop tolerance, and compatability in tank mixtures with grass herbicides.

To evaluate currently available grass herbicides for efficacy and crop tolerance.

SUMMARY:

Clopyralid was very effective in controlling established Canadian thistles with minimum crop injury. Grass control may be deleteriuosly affected when sethoxydim is combined with clyopyralid. Growth regulator reactions have been observed on mint following clopyralid applications.

Sequential applications of all the grass herbicides evaluated provided good suppression of quackgrass. All the grass herbicide treatments, except Verdict provided fair to good grass suppression with one application.

RESEARCH METHODS:

All herbicide treatments were applied post-emergence to established peppermint stands using a tractor-mounted, research-type sprayer. Plots were 10' by 20' on the Evans farm and 10' by 10' on the Ficken farm. Where allowable plots were arranged in randomized complete blocks and replicated four times. A spray volume of 24.85 gpa was applied using 8002 nozzles at 32 psi. Application data for each test site follows the tables listing data for those tests.

RESULTS:

In interpretation of data and observations concerning these studies a factor that needs to be taken into consideration is that each test site received applications of terbacil (Sinbar).

Evans farm:

The clopyralid applications were timed at the lastest possible date (June 1) although an earlier treatment may have been more effective in quackgrass control had weather conditions been favorable. This late application date may have been timely for the number of emerged thistles but was very late to effectively control quackgrass which was 8- 16 " tall. The thistles were 8" and smaller.

RESULTS (Cont'd).

While the thistle population was moderate-to-high with good uniformity, the quackgrass pressure was spotty at best. It would be safest to say that the grass herbicide applications were made to sparse areas of quackgrass that were under stress from terbacil applications.

There was no increased control of quackgrass with an increased rate of fluaziflop at the first rating (7/5/89) but there was a slight increase in control observed at the second rating (8/3/89). Note that even though both applications of the sequential treatments had been sprayed by the time of the first rating the second rating may be more realistic because the second application of the sequential treatments by that time had become effective. There was not an increase in quackgrass control seen in the later observations for the higher rates of sethoxydim. This could have been a result of the chemical atagonism potential that sethoxydim possesses, or related to the low population of quackgrass, thus failing to give us an acurate reading.

Percent bloom on mint was observed to be significantly less in the plots treated with the high rate of clopyralid (.25 lb/a). Height was not adversely effected by any treatment. Early observations suggested clopyralid may reduce height, stems, and leaves yet this was not substantiated at the end of the season. Discoloration (lighter color with a less degree of the purple color characteristic to peppermint) was noticed earlier in the season in the clopyralid plots.

Table 2 gives percent thistle control on two different dates. All clopyralid treatments gave good to excellant thistle control when rated 7/5/89 while both bromoxynil and bentazon gave very poor control. In the second weed control rating (8/3/89) overall thistle control for the clopyralid treatments was very good, lower rates controlling the older, original thistle plants, while the higher rates gave a more comprehensive control of all thistles. Thistle reoccurrance was highest in the check indicating all treatments had some effect on thistle reoccurance.

Table 3 list some agronomic measurements obtained from five treatments which highlight differences found in several plant characteristics. Three flowering terminals were selected at random from each plot in each replication. From those terminals the last flowering branch (pedicel) was measured. These lengths and the differences can be seen in Table 3 for two clopyralid treatments, the bromoxynil and the bentazon treatments, and the check. The high rate of clopyralid produced the greatest difference in length and mean length of pedicels.

Observations, nor hard data from this study, do not give strong support for significant synergistic or antagonistic effects of clopyralid in combinations with grass herbicides but do suggest the need for further investigations.

Ficken farm:

Terbacil had been applied earlier in the season on the Ficken farm and the quackgrass population was showing slight chlorosis and stress. One series of plots was positioned in a field that was expressing slight injury from terbacil, while the other one was located near an irrigtion main line where the terbacil application had not injured a moderate stand of quackgrass.

RESULTS (Cont'd)

In the first study excellent quackgrass suppression was observed in all treated plots (on 7/20 and 8/4) except where the single application of Verdict (haloxyfop) had been applied.

In the second study there also was excellent quackgrass suppression yet there was less activity on quackgrass with using the lower rates of some herbicides. This lack of control may be attributed to a late application date (quackgrass was forming seed) or to the physiological disruption already in progress due to terbacil injury. The application of all herbicides (except Verdict at .25 lb ai/A) controlled the regrowth of quackgrass. Weed control in the checks of each study demonstrate that terbacil did have an affect on the quackgrass populations (normally there would be no weed control in the check).

FUTURE TESTING POSSIBILITIES:

- Fall plus spring clopyralid rate and application evaluations. Attempt through fall herbicide management to eliminate winter annuals like common groundsel (Senecio vulgaris), wild pansey (Voila arvensis), young Canadian thistles (Cirsium arvense), and others.

- Evaluation of combined herbicide treatments for broad spectrum weed control.

- Continued efficacy trials and enlarging data bases on yet-to-be-registered agrichemicals.

CHEMICAL AND TRADE NAMES OF TREATMENTS USED

Clopyralid	Stinger
Fluazifop	Fusliade
Sethoxydim	Poast
Bromoxynil	Brominal or Buctril
Bentazon	Basagran
Haloxyfop	Verdict
DPX-Y6202	Assure
SC 1084	Trophey

Table 1. Agronomic data from the mint herbicide study grown on Evans farm, Kalispell, MT in 1989.

	Treatment	lb ai/A	% Qkgrs Cntrl 2/ 7/5	% Qkgrs Cntrl 2/ 8/3	% Bloom Mint 8/11	HT(cm) 3/ Mint 8/3
1.	Clopyralid	.1875	.0000	.0000	85.0	43.00
2.	Clopyralid	.125	.0000	.0000	83.8	43.00
3.	Clopyralid	.25	.0000	.0000	76.3	43.00
4.	Clopyralid + Fluazifop 1/	.125 + .1875 +.125	66.00	88.75	93.8	41.75
5.	Clopyralid + Fluazifop 1/	.125 + .25 +.1875	46.25	95.00	87.5	41.50
6.	Clopyralid + Sethoxydim 1/	.125 + .28 +.1875	68.75	91.25	92.5	41.75
7.	Clopyralid + Sethoxydim 1/	.125 + .46 +.46	91.46	78.79	92.7	42.80
8.	Bromoxynil	.25	11.88	12.50	81.3	41.75
9.	Bentazon	1.5	.0000	.0000	85.0	40.75
10.	Check	----	.0000	.0000	88.8	42.75

SUMMARY STATISTICS:

OVERALL MEAN	26.98	35.75	86.50	42.17
F-RATIO TRTS	7.264**	77.56**	3.157**	1.109 NS
P-VALUE TRTS	.0000	.0000	.0089	.3921
CV (SE/MEAN)	44.66	13.74	3.537	1.789
LSD(0.05 by t)	36.91	14.63	8.908	2.195

1/ Fluazifop and sethoxydim applications were tank mixed with clopyralid in the first applications and applied alone in the sequential applications. The second rate given for both fluazifop and sethoxydim is the sequential treatment which was applied eighteen days after the first application (sixty days prior to harvest). AL 411F (at .25% v/v) was added to the fluazifop treatment and Dash (2 pt/A) was added to the sethoxydim treatments.

2/ Ratings: % Qkgrs Cntrl = Ocular rating of % Quackgrass (Agropyron repens) control on 7/5/89 and 8/3/89

3/ % Bloom rating = % of mint in plot begining to bloom

Table 2. Agronomic data from the mint herbicide study grown on Evans farm, Kalispell, MT in 1989. Canadian thistle control.

	Treatment	lb ai/A	----- Percent Thistle Control 2/ ----- All 7/5	All 8/3	Orig 8/3	New 8/3	Thistle /3 Reoccur
1.	Clopyralid	.1875	97.50	93.75	100.0	80.00	2.75
2.	Clopyralid	.125	98.50	91.00	93.50	74.75	.875
3.	Clopyralid	.25	98.75	86.00	87.50	96.25	1.50
4.	Clopyralid + Fluazifop 1/	.125 + .1875 +.125	91.25	88.75	96.25	78.75	1.25
5.	Clopyralid + Fluazifop 1/	.125 + .25 +.1875	92.50	86.25	92.50	68.75	1.13
6.	Clopyralid + Sethoxydim 1/	.125 + .28 +.1875	96.25	91.25	92.50	96.25	2.38
7.	Clopyralid + Sethoxydim 1/	.125 + .46 +.46	99.17	94.18	96.45	87.20	2.63
8.	Bromoxynil	.25	12.50	37.50	39.38	23.13	2.13
9.	Bentazon	1.5	5.000	62.50	62.50	40.00	1.50
10.	Check	----	.0000	.0000	.0000	.0000	3.89

SUMMARY STATISTICS:

	OVERALL MEAN	67.85	75.05	63.35	64.60	2.00
	F-RATIO TRTS	69.62**	12.67**	16.61**	12.20**	1.48NS
	P-VALUE TRTS	.0000	.0000	.0000	.0000	.204
	CV (SE/MEAN)	7.548	11.95	10.52	14.36	38.1
	LSD(0.05 by t)	15.17	25.40	23.36	26.93	2.20

1/ Fluazifop and sethoxydim applications were tank mixed with clopyralid at first application and applied alone in the sequential application. The second rate given for both fluazifop and sethoxydim is the sequential treatment which was applied eighteen days after the first application (sixty days prior to harvest). AL 411F (at .25% v/v) was added to the fluazifop treatment and Dash (2 pt/A) was added to the sethoxydim treatments.

2/ Percent thistle control ratings: "All" refers to a rating of all thistles present in plot, "Orig" refers to just the older thistles that had blooms at the time of rating, "New" refers to those younger thistles having emmerged since clopyralid applications. All the above ratings are in percent control.

3/ Reoccur ratings are on a 1-5 scale and denote the degree of thistle regrowth infestation (mainly new thistle, not in bloom). 0 = none, 5 = vigorous regrowth of thistle.

Table 3. Agronomic data from the mint herbicide study grown on the Evans Farm, Kalispell MT

Treatment	Rate lb ai/A	1/ #Flwrs Obsvr	2/ # Pedicl Abnorm	3/ % Abnorm Pedicl	4/ $\bar{X}$ Diff Length	5/ $\bar{X}$ Length Pedicl	6/ Br Intr Length	7/ Leaf Length
Check	-----	3.0	.0 A	.0 A	.0 A	2.8 A	19.43 B	28.33 BC
Bentazon	1.5	3.0	.3 A	8.3 AB	3.0 A	3.2 A	26.53 C	29.50 BC
Bromoxynil	.25	3.0	1.3 CB	41.3 AB	3.5 AB	4.2 A	9.43 A	24.42 AB
Clopyralid	.125	3.0	1.0 B	33.0 BC	.8 A	2.9 A	13.68 AB	22.83 A
Clopyralid	.25	3.0	1.8 C	58.3 C	7.6 B	8.0 B	18.65 B	30.83 C
OVERALL MEAN =		3.000	.8500	28.15	2.960	4.165	17.54	27.18
F-RATIO TRTS =		17.61**	4.698*	4.695*	2.071	5.952**	4.044*	1.932
P-VALUE TRTS =		.0000	.0131	.0132	.1399	.0054	.0220	.1623
CV (SE/MEAN) =		.47E-06	39.09	39.22	69.45	21.56	18.28	9.028
LSD(0.05 by t)=		.44E-07	1.024	34.02	6.334	2.767	9.880	7.561

Multiple comparisons are 0.05 LSD.

1/ # Flwrs obsrvd = number of flower terminals examined/plot
2/ # Pedicl abnorm = number of those pedicles with abnormal growth
3/ % Abnorm Pedicl = the percentage of those flower terminals that were abnormal in length of pedicel
4/ $\bar{X}$ Diff Length = average difference of abnormal pedicels
5/ $\bar{X}$ Length Pedicel = average length of pedicel
6/ Br Intr Length = stem internode length between top two leaves
7/ Leaf Length = length of leaf (1st leaf below flower)

Application data:

	1st Application	Sequential
Date	6/1/89	6/19/89
Air (F)	72	59
Rel. Hum. %	25	22
Soil(F)	65	65
Wind	2-3 mph, South	0-2 mph, SSE
Cloud cover	Cloudy	Cloudy
Soil moist.	Very good	Very good
Crop stage	3-5 "	8 "
Weed stages		
Thistles	seedling to 8"	12-14"
Quackgrass	8-16 "	14-18"
note:	Sinbar applications had effected quackgrass slightly (yellowing and thinning)	

Applications made with research-type plot sprayer to plots that were 10' X 20' in 24.85 gallons per acre at 32 PSI.

Table 4. Agronomic data from the Mint Herbicide Study on Ficken's farm, Kalispell, MT, 1989. Study #1

Treatment	Rate	Percent Quackgrass Suppression 7/20	8/4	Regrwth 7/20	Ht (CM) Mint
Verdict	.25	37.50	45.00	50.00	42.50
Verdict	.25+.25	85.00	100.0	100.0	39.50
Fusilade	.25	89.00	93.50	100.0	41.50
Fusildae	.25+.25	93.00	90.00	100.0	43.00
Sethoxydim	.46	97.50	85.00	100.0	43.50
Sethoxydim	.46+.46	94.00	100.0	100.0	43.50
Assure	.5	100.0	92.50	100.0	43.00
Assure	.5+.5	96.50	97.50	100.0	42.00
SC 1084	.5	95.00	95.00	100.0	42.50
SC 1084	.5+.5	87.50	87.50	100.0	41.00
Check		49.00	50.00	50.00	41.50
OVERALL MEAN	=	84.00	85.09	90.91	42.14
F-RATIO TRTS	=	1.063	.7598	.8182	1.379
P-VALUE TRTS	=	.4654	.6716	.6283	.3100
CV (SE/MEAN)	=	24.00	25.90	24.60	2.437
LSD(0.05 by t)	=	63.53	69.45	70.46	3.236

Table 5. Agronomic data from the Mint Herbicide Study on Ficken's farm, Kalispell, MT, 1989. Study #2, next to main line.

Treatment	Rate	Percent Quackgrass Suppression 7/20	8/4	Regrowth 7/20	Ht(CM) Mint
Verdict	.25	50.00	47.50	50.00	45.50
Verdict	.25+.25	82.50	92.50	100.0	42.50
Fusilade	.25	95.00	89.50	100.0	44.00
Fusildae	.25+.25	97.00	85.00	100.0	44.00
Sethoxydim	.46	70.00	67.50	100.0	45.00
Sethoxydim	.46+.46	87.50	97.50	100.0	46.00
Assure	.5	85.00	75.00	100.0	46.50
Assure	.5+.5	95.00	90.00	100.0	47.00
SC 1084	.5	95.00	92.50	100.0	46.50
SC 1084	.5+.5	79.50	82.50	100.0	45.50
Check		47.50	46.00	50.00	45.50
OVERALL MEAN	=	80.36	78.68	90.91	45.27
F-RATIO TRTS	=	.5666	.7124	.8182	1.446
P-VALUE TRTS	=	.8175	.7074	.6283	.2844
CV (SE/MEAN)	=	29.14	27.00	24.60	2.442
LSD .05	=	73.78	66.93	70.46	3.484

Application Data:

Date:	6/28/89	7/20/89
Air temp:	70 F	85 F
Soil temp:	63 F	83 F
Rel Humid:	15 %	30 %
Wind, MPH:	2-3, SSE	0-2, SSE
Cloud cover:	Clear	Clear
Soil Moisture:	Very Good	Very Good

Stage of Growth

Mint:	18-24"	20-26"
Quack:	30"	30"

YEAR/PROJECT: 1989/755 1989 INTRASTATE ALFALFA YIELD TRIAL-IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

Twenty-eight alfalfa varieties were seeded in a RCB design with four replications on 20 April, 1989. On 6/27/89 stand ratings were obtained using a 2 x 20 square grid. The varieties showing the best initial stand establishment were Fortress, Vernema, WL-87-21, VS-775, Arrow, Eagle, WL-317, Thor, Pioneer 5262, XAL-72, and Apollo Supreme. Occupancy of these varieties ranged from 90% to 98%. NC831XMTV1-V2 had significantly poorer stand establishment than any other variety at only 53% occupancy.

First harvest was obtained on 7/26/89. Vernema (1.93 t/a) Fortress, VS-775, Cimarron VR and VS-872 had the highest yields, while NC831XMTV1-V2 (1.08 t/a) had significantly lower yield than any other variety. This low yield was probably related to the poor stand establishment. Fall harvest was obtained on 10 October. Fortress (1.67 t/a), WL-87-21, VS-872, and VS-775 had the highest yields. Ladak-65 (0.92 t/a), Vernal and Wrangler had the lowest yields. Total yields for 1989 ranged from 3.47 t/a for Fortress to 2.33 t/a for NC831XMTV1-V2.

INTRASTATE ALFALFA TRIAL - SEEDED 1989
KALISPELL - IRRIGATED - 1989 YIELDS

VARIETY	VERT WILT RESIST	STAND 6/27 %	HARVEST-1 7/26/89 t/a	HARVEST-2 10/10/89 t/a	TOTAL t/a
Fortress	R	93	1.80	1.67	3.47
Vernema	MR	95	1.93	1.45	3.38
VS-872	R	81	1.72	1.55	3.27
WL-87-21	R	98	1.69	1.57	3.26
VS-775	R	90	1.77	1.49	3.26
Cimarron VR	HR	86	1.74	1.46	3.20
Arrow	R	91	1.64	1.44	3.08
86I-08	HR	86	1.65	1.41	3.06
Garst-630	MR	80	1.64	1.36	3.00
Eagle	MR	94	1.56	1.41	2.97
WL-317	R	90	1.61	1.35	2.96
Thor	--	96	1.57	1.38	2.95
5262	LR	95	1.66	1.28	2.94
Sabre	HR	88	1.61	1.32	2.93
Milkmaker	S	81	1.58	1.34	2.92
5364	MR	85	1.54	1.34	2.88
AP-8735	--	80	1.51	1.36	2.87
Garst-636	R	84	1.56	1.29	2.85
XAL-72	MR	93	1.50	1.30	2.80
Apollo Supreme	R	93	1.50	1.29	2.79
MF-87758	--	88	1.57	1.15	2.72
Glean-Cycle 1	--	68	1.44	1.22	2.66
WL-88-9	R	89	1.49	1.16	2.65
Vernal	--	98	1.55	1.09	2.64
Wrangler	LR	86	1.54	1.09	2.63
MTV4-V1	--	84	1.42	1.20	2.62
Ladak-65	S	89	1.54	0.92	2.46
NC831XMTV1-V2	--	53	1.08	1.25	2.33
LSD(0.05)		9	0.24	0.19	0.32
P-VALUE		0.00	0.00	0.00	0.00
CV(s/mean)		7.5	10.6	10.1	7.9

Seeding date: 4/20/89
Fertilizer: P2O5 - 176 lbs/a
Pesticides: 5/4 and 5/22/89 - Poast - 1.5 pt/a
Crop year precipitation: 23.39"
Irrigation: 5.25"
Last spring frost: 5/21 (32 degrees F)
First fall frost: 9/9 (29 degrees F)

YEAR/PROJECT: 1989/755 1989 INTRASTATE ALFALFA YIELD TRIAL-DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

Twenty-three alfalfa varieties were seeded in a RCB design with four replications on 24 April, 1989. On 6/27/89 stand ratings were obtained using a 2 x 20 square grid. The varieties showing the best initial stand establishment were 'Fortress', 'Pioneer 5262', 'VS-775', 'Eagle', 'VS-872', 'Vernema', and 'MF-87758'. Occupancy of these varieties ranged from 91% to 95%. 'Thor', '5364', 'AP-8735', 'WL-317', '86I-08', 'Milkmaker', 'Vernal', 'Wrangler' and 'Garst-636' had the poorest establishment (71-82%). First harvest was obtained on 7/21/89. VS-872, 'Garst-630', 'VS-775', 'Apollo Supreme' and Pioneer 5262 had the highest yields (1.73-1.52 t/a), while Thor (1.19 t/a) had the lowest. Stand establishment for these high yielding varieties was between 85% and 92%, while Thor had only a 71% stand after emergence. Fall harvest was cut 10 October. Fortress (2.21 t/a), 'Arrow', 'Cimarron VR' and VS-872 had the highest yields. 'Ladak-65' (1.51 t/a) had the lowest yields. The varieties with the highest total yields for 1989 were VS-872 (3.72 t/a), Fortress, Garst-630, Cimarron VR and Arrow. MF-87758 (2.83 t/a) and Ladak-65 (2.86 t/a) had the lowest yields.

INTRASTATE ALFALFA TRIAL - SEEDED 1989
KALISPELL - DRYLAND - 1989 YIELDS

VARIETY	VERT WILT RESIST	STAND 6/27 %	HARVEST-1 7/21/89 t/a	HARVEST-2 10/10/89 t/a	TOTAL t/a
VS-872	R	91	1.73	1.99	3.72
Fortress	R	95	1.40	2.21	3.61
Garst-630	MR	86	1.70	1.88	3.58
Cimarron VR	HR	84	1.41	2.02	3.43
Arrow	R	86	1.30	2.10	3.40
5364	MR	75	1.49	1.82	3.31
Sabre	HR	88	1.38	1.91	3.29
Vernema	MR	91	1.34	1.86	3.20
86I-08	HR	80	1.45	1.75	3.20
Apollo Supreme	R	85	1.53	1.62	3.15
5262	LR	92	1.52	1.61	3.13
VS-775	R	92	1.57	1.54	3.11
Eagle	MR	92	1.43	1.66	3.09
Milkmaker	S	81	1.36	1.72	3.08
Vernal	--	82	1.26	1.78	3.04
WL-317	R	77	1.28	1.75	3.03
Wrangler	LR	81	1.41	1.61	3.02
XAL-72	MR	86	1.37	1.61	2.98
Garst-636	R	82	1.32	1.64	2.96
Thor	--	71	1.19	1.76	2.95
AP-8735	--	75	1.35	1.60	2.95
Ladak-65	S	85	1.35	1.51	2.86
MF-87758	--	91	1.29	1.54	2.83
LSD(0.05)		12	0.23	0.24	0.36
P-VALUE		0.00	0.00	0.00	0.01
CV(s/mean)		10.0	11.4	9.8	8.1

Seeding date: 4/24/89
Fertilizer: P2O5 - 176 lbs/a
Crop year precipitation: 23.39"
Last spring frost: 5/21 (32 degrees F)
First fall frost: 9/9 (29 degrees F)

YEAR/PROJECT: 1989/755 1988 INTRASTATE ALFALFA YIELD TRIAL-IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

First harvest was cut on 5/31/89. 'ICB-34' had the highest yield with 2.68 t/a. 'Vernal', at 2.36 t/a, was the lowest yielding. Second harvest yields on 7/6/89 ranged from 2.23 t/a for 'Pioneer 5432' to 1.86 t/a for 'Ladak-65'. Ladak-65 had significantly lower yields than any variety but 'Vista-663'. Third harvest was cut on 8/3/89. Pioneer 5432, at 1.32 t/a, had significantly higher yields than any other variety, and Ladak-65, with 1.03 t/a, had significantly lower yields than any of the others. Fall harvest was cut on 10/4/89. 'DK-125' and 'Sparta' had significantly higher yields than the other varieties, while Ladak-65 had lower yields than any other. The top yielding varieties for 1989 were Pioneer 5432, ICB-34, DK-125, 'Legend', and 'Sure'. Ladak-65 had significantly lower yields than any other variety tested.

Total yields for the 1988 and 1989 seasons ranged from 10.20 t/a for ICB-34 to 8.77 t/a for Ladak-65. Ladak-65 yielded significantly less than the other varieties.

INTRASTATE ALFALFA TRIAL - SEEDED 1988
KALISPELL - IRRIGATED 1989 YIELDS

VARIETY	VERT W. RESIST.	STAND 4/25 %	HARV-1 5/31	HARV-2 7/6	HARV-3 8/3	HARV-4 10/4	TOTAL
			t/a				
Pioneer 5432	R	97	2.62	2.23	1.32	1.11	7.28
ICB-34	LR	99	2.68	2.22	1.26	1.11	7.27
DK-125	R	97	2.66	2.12	1.24	1.17	7.19
Legend	R	98	2.66	2.07	1.20	1.13	7.06
Sure	R	97	2.64	2.09	1.20	1.12	7.05
Sparta	R	99	2.56	2.04	1.20	1.18	6.98
Thor	--	96	2.55	2.13	1.18	1.08	6.94
Garst-636	R	98	2.53	2.13	1.22	1.06	6.94
Vista-661	MR	98	2.59	2.07	1.19	1.08	6.93
Edge	R	97	2.55	2.09	1.20	1.08	6.92
WL-316	R	98	2.58	2.07	1.21	1.04	6.90
Arrow	R	97	2.49	2.07	1.22	1.10	6.88
AgriBoss	MR	97	2.46	2.06	1.22	1.10	6.84
Kingstar	R	98	2.42	2.16	1.26	0.99	6.83
Premier	R	96	2.47	2.10	1.26	0.98	6.81
WL-225	R	97	2.48	2.05	1.16	1.06	6.75
Wrangler	LR	98	2.54	2.05	1.16	0.93	6.68
Vista-663	MR	96	2.50	1.96	1.12	1.05	6.63
Vernal	--	97	2.36	2.11	1.22	0.91	6.60
Ladak-65	--	97	2.44	1.86	1.03	0.80	6.13
LSD(0.05)			0.13	0.11	0.05	0.07	0.30
P-VALUE			0.00	0.00	0.00	0.00	0.00
CV(s/mean)			3.7	3.6	3.2	4.5	3.1

Seeding date: 5/3/88
Pesticide: 10/26/89 - Sencor - 1 lb AI/a
Crop year precipitation: 23.39 inches
Irrigation: 4 inches
Last spring frost: May 21 (32 degrees F)
First fall frost: Sept.9 (29 degrees F)

INTRASTATE ALFALFA TRIAL - SEEDED 1988
KALISPELL - IRRIGATED 1988-1989 YIELDS

VARIETY	VERT W. RESIST.	1988	1989	TOTAL YIELD
		t/a		
ICB-34	LR	2.93	7.27	10.20
Legend	R	3.07	7.06	10.13
Sure	R	3.05	7.05	10.10
Sparta	R	3.06	6.98	10.04
DK-125	R	2.84	7.19	10.03
Edge	R	3.07	6.92	9.99
Thor	--	2.96	6.94	9.90
Pioneer 5432	R	2.56	7.28	9.84
Vista-661	MR	2.91	6.93	9.84
Arrow	R	2.89	6.88	9.77
Vista-663	MR	3.13	6.63	9.76
WL-316	R	2.77	6.90	9.67
AgriBoss	MR	2.82	6.84	9.66
WL-225	R	2.86	6.75	9.61
Garst-636	R	2.60	6.94	9.54
Kingstar	R	2.67	6.83	9.50
Wrangler	LR	2.81	6.68	9.49
Premier	R	2.62	6.81	9.43
Vernal	--	2.65	6.60	9.25
Ladak-65	--	2.64	6.13	8.77
LSD(0.05)		0.31	0.30	0.48
P-VALUE		0.00	0.00	0.00
CV(s/mean)		7.8	3.1	3.5

Seeding date: 5/3/88
Fertilizer: Spring 1988 - P2O5 - 200 lbs/a
Pesticide: 10/26/89 - Sencor - 1 lb AI/a
Crop year precipitation: 13.94" 23.39"
Irrigation: 12" 4"

YEAR/PROJECT: 1989/755 1988 INTRASTATE ALFALFA YIELD TRIAL-DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

First harvest was cut on 5/31/89. 'Vista-663' had the highest yield with 2.09 t/a. 'Kingstar', at 1.53 t/a, was the lowest yielding. Second harvest yields on 7/19/89 ranged from 1.89 t/a for 'Wrangler' to 1.50 t/a for 'WL-225'. Fall harvest was cut on 10/9/89. Vista-663 had the highest yield at 2.07 t/a. 'Ladak-65', with 1.38 t/a, had significantly lower yields than any other variety. The top yielding variety for 1989 was Vista-663 at 5.94 t/a, and the lowest was 'Premier' at 4.81 t/a. Total yields for the 1988 and 1989 seasons combined ranged from 8.10 t/a for Vista-663 to 6.68 t/a for Premier. The yields overlapped considerably, but the statistics indicated Vista-663, 'DK-125', 'Edge', 'Legend', 'Sure' and Wrangler had significantly higher total yields than Premier, WL-225, Kingstar, 'WL-316', 'Pioneer 5432' and 'ICB-34'.

INTRASTATE ALFALFA TRIAL - SEEDED 1988
KALISPELL - DRYLAND 1989 YIELDS

VARIETY	VERT W RESIS	STAND 4/24	Harv-1 5/31	Harv-2 7/19	Harv-3 10/9	TOTAL
		%	t/a			
Vista-663	MR	96	2.09	1.78	2.07	5.94
DK-125	R	98	2.05	1.82	1.99	5.86
Legend	R	96	2.00	1.76	1.97	5.73
Sure	R	96	1.92	1.76	1.99	5.67
Vista-661	MR	97	1.92	1.74	1.95	5.61
Sparta	R	99	1.97	1.61	2.01	5.59
Edge	R	95	1.89	1.76	1.93	5.58
Wrangler	LR	99	2.02	1.89	1.63	5.54
Thor	--	96	1.88	1.76	1.87	5.51
Garst-636	R	98	1.94	1.65	1.78	5.37
AgriBoss	MR	96	1.84	1.71	1.82	5.37
Vernal	--	99	1.91	1.80	1.59	5.30
Pioneer 5432	R	99	1.89	1.65	1.66	5.20
Arrow	R	97	1.73	1.57	1.88	5.18
ICB-34	LR	99	1.89	1.59	1.67	5.15
Ladak-65	--	97	1.95	1.67	1.38	5.00
WL-225	R	96	1.82	1.50	1.67	4.99
WL-316	R	94	1.69	1.53	1.67	4.89
Kingstar	R	92	1.53	1.63	1.70	4.86
Premier	R	94	1.63	1.58	1.60	4.81
LSD(0.05)			0.20	0.25	0.19	0.51
P-VALUE			0.00	0.18	0.00	0.00
CV(s/mean)			7.4	10.5	7.4	6.8

Seeding date: 5/4/88
Fertilizer: Spring 1988 - P - 200 lbs/a
Pesticides: 10/26/89 - Sencor - 1 lb AI/a
Crop year precipitation: 23.39 inches
Last spring frost: May 21 (32 degrees F)
First fall frost: Sept. 9 (29 degrees F)

INTRASTATE ALFALFA TRIAL - SEEDED 1988
KALISPELL - DRYLAND 1988-1989 YIELDS

VARIETY	VERT W RESIS	1988 t/a	1989 t/a	TOTAL t/a
Vista-663	MR	2.16	5.94	8.10
DK-125	R	2.18	5.86	8.04
Edge	R	2.28	5.58	7.86
Legend	R	2.10	5.73	7.83
Sure	R	2.07	5.67	7.74
Wrangler	LR	2.06	5.54	7.60
Vista-661	MR	1.98	5.61	7.59
Sparta	R	1.90	5.59	7.49
Thor	--	1.94	5.51	7.45
Garst-636	R	1.96	5.37	7.33
AgriBoss	MR	1.90	5.37	7.27
Arrow	R	2.01	5.18	7.19
Vernal	--	1.88	5.30	7.18
Ladak-65	--	2.10	5.00	7.10
ICB-34	LR	1.90	5.15	7.05
Pioneer 5432	R	1.82	5.20	7.02
WL-316	R	2.03	4.89	6.92
Kingstar	R	2.03	4.86	6.89
WL-225	R	1.88	4.99	6.87
Premier	R	1.87	4.81	6.68
LSD(0.05)		0.34	0.51	0.74
P-VALUE		0.45	0.00	0.00
CV(s/mean)		11.9	6.8	7.1

Seeding date: 5/4/88
Fertilizer: Spring 1988 - P - 200 lbs/a
Pesticides: 10/26/89 - Sencor - 1 lb AI/a
Crop year precip.: 13.94" 23.39"

YEAR/PROJECT: 1989/755 1986 INTRASTATE ALFALFA YIELD TRIAL-IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

First harvest was cut on 6/12/89. 'Baker' with additional K had the highest yield with 2.90 t/a. 'Excalibur', at 2.23 t/a, was the lowest yielding variety, being significantly lower than all varieties but 'GH737', 'Apollo II' and 'Thorobred'. Second harvest yields on 7/24/89 ranged from 2.38 t/a for 'Verta +' to 1.78 t/a for 'Spredor II'. Verta + had significantly higher yields than any variety but 'Centurion'. Third harvest was cut on 10/3/89. Verta +, Centurion, 'NY 8412', 'Sparta', and 'Crown' had the highest yields, and 'Ladak 65', 'Vernal', 'Thor', Thorobred and Spredor II had the lowest. The top yielding varieties for 1989 were Verta +, Centurion, 'NY 8412', Sparta, 'WL 225', Crown, 'NY 8413' and 'AP 45'. All are rated R or HR for Verticillium wilt resistance. The lowest yielding varieties - Spredor II, Thorobred, Thor and Vernal - are not Verticillium wilt resistant.

Four-year total yields ranged from 29.50 t/a for Verta + to 25.01 t/a for Ladak-65 with K. Of the top 17 varieties, only two (Baker with K and 'Anstar') do not have Verticillium wilt resistance. None of the eight lowest yielding varieties have resistance to Verticillium wilt. Applying additional potassium (K at 100 lbs K2O/A) did not increase yields of Ladak-65, Baker or Vernal.

INTRASTATE ALFALFA TRIAL - SEEDED 1986
KALISPELL - IRRIGATED 1989 YIELDS

VARIETY	VERT W. RESIST.	% STAND 4/30/89	HARVEST-1 6/12/89	HARVEST-2 7/24/89	HARVEST-3 10/3/89	TOTAL
		---%-	----------t/a----------			
Verta +	R	83	2.76	2.38	1.87	7.01
Centurion	R	79	2.80	2.24	1.76	6.80
NY 8412	HR	82	2.87	2.09	1.74	6.70
Sparta	R	88	2.78	2.14	1.74	6.66
WL 225	R	81	2.88	2.09	1.64	6.61
Crown	R	75	2.57	2.19	1.84	6.60
NY 8413	HR	67	2.77	2.14	1.67	6.58
AP 45	R	81	2.82	2.07	1.67	6.56
Surpass	R	85	2.69	2.13	1.70	6.52
Baker-K *	---	86	2.90	2.07	1.54	6.51
Blazer	LR	84	2.81	2.13	1.42	6.36
Anstar	---	86	2.62	2.09	1.58	6.29
WL 316	R	86	2.54	2.11	1.60	6.25
Baker	---	88	2.62	2.02	1.58	6.22
GH737	R	78	2.50	1.95	1.65	6.10
Excalibur	R	71	2.23	2.11	1.65	5.99
Apollo II	MR	80	2.44	1.93	1.55	5.92
Elevation	MR	81	2.52	1.92	1.47	5.91
Ladak 65	---	86	2.84	1.93	1.08	5.85
Ladak 65-K*	---	88	2.88	1.80	1.11	5.79
Vernal	---	77	2.63	1.90	1.10	5.63
Thor	---	87	2.57	1.91	1.12	5.60
Vernal-K*	---	76	2.56	1.83	1.12	5.51
Thorobred	---	75	2.30	1.81	1.27	5.38
Spredor II	---	87	2.51	1.78	0.98	5.27
LSD(0.05)		16	0.28	0.16	0.15	0.46
P-VALUE		0.56	0.00	0.00	0.00	0.00
CV (s/mean)		14.3	7.4	5.7	7.3	5.2

* K = 100 lbs K2O/a

Seeding date: 4/30/86
Crop year precipitation: 23.39 inches
Irrigation: 4"
Last spring frost: May 21 (32 degrees F)
First fall frost: Sept.9 (29 degrees F)

INTRASTATE ALFALFA YIELD TRIAL - SEEDED 1986
KALISPELL - IRRIGATED - 1986-1987 TOTAL YIELDS

VARIETY	VERT.W. RESIS.	1986	1987	1988	1989	TOTAL
		t/a				
VERTA +	R	4.13	7.85	10.51	7.01	29.50
EXCALIBUR	R	4.12	8.14	10.33	5.99	28.58
CENTURION	R	3.85	7.73	10.20	6.80	28.58
CROWN	R	3.94	7.80	10.01	6.60	28.35
SPARTA	R	3.88	7.87	9.68	6.66	28.09
SURPASS	R	3.66	7.62	10.13	6.52	27.93
NY 8412	HR	3.85	7.28	9.65	6.70	27.48
BAKER-K *	--	3.65	7.37	9.79	6.51	27.32
BLAZER	LR	3.63	7.90	9.41	6.36	27.30
ANSTAR	--	3.66	7.65	9.69	6.29	27.29
NY 8413	HR	3.65	7.52	9.48	6.58	27.23
ELEVATION	MR	3.77	7.81	9.61	5.91	27.10
WL 225	R	3.65	7.54	9.21	6.61	27.01
WL 316	R	3.61	7.36	9.67	6.25	26.89
AP 45	R	3.37	7.54	9.34	6.56	26.81
GH 737	R	3.78	7.61	9.25	6.10	26.74
APOLLO II	MR	3.81	7.60	9.37	5.92	26.70
THOR	--	3.85	7.78	9.39	5.60	26.62
BAKER	--	3.55	7.12	9.31	6.22	26.20
SPREDOR II	--	3.57	7.76	8.86	5.27	25.46
VERNAL-K *	--	3.52	7.61	8.63	5.51	25.27
THOROBRED	--	3.59	7.54	8.74	5.38	25.25
VERNAL	--	3.47	7.23	8.83	5.63	25.16
LADAK 65	--	3.27	7.34	8.62	5.85	25.08
LADAK 65-K *	--	3.36	7.37	8.49	5.79	25.01
LSD(0.05)		0.26	0.40	0.54	0.46	
P-VALUE		0.00	0.00	0.00	0.00	
CV(s/mean)		10.2	3.7	4.0	5.2	

* 100 lbs/a K2O in 1987,1988,1989 and 1990
Seeding date: 4/30/86
Fertilizer: 5/15/86 - P2O5 - 180 lbs/a
Fall '87 - P2O5 - 110 lbs/a, S - 45 lbs/a
Pesticides: 4/29/86: Eptam - 4 lbs AI/a + 2,4-DB
7/2/86 - Imidan - 1 lb AI/a for weevil control
10/28/88 - Lexone - 0.75 lbs AI/a
10/25/89 - Sencor - 1 lb AI/a
Crop yr precip (in): 23.23 21.97 13.94 23.39

YEAR/PROJECT: 1989/755 1984 INTRASTATE ALFALFA YIELD TRIAL-IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

As a final evaluation of the varieties in this nursery, spring stands were estimated, and yields from one cutting were taken and separated into legume and non-legume components. Percent stand was measured using a 2 x 20 square grid on 4/28/89. The varieties showing the most stand persistence over the five years were 'Oneida VR' at 52%, 'Arrow' at 47%, and 'Commandor' at 42%. These varieties are rated HR, R, and MR respectively for Verticillium wilt resistance. Of the 13 varieties with less than 20% stand remaining, only three ('DK-135', 'Maxim', and 'Decathlon') had some resistance to Vert wilt.

Verticillium wilt was observed in the nursery in 1985. The first yield reductions occurred in 1986 from this disease. In 1987, 1988 and first harvest in 1989, most varieties without resistance yielded less than resistant varieties. Interestingly, Maxim, which was rated R, was susceptible to Vert wilt. We also observed this under field conditions for Maxim. First harvest yields in 1989 reflected previous years' Vert wilt pressure and the ability of the varieties to survive after the severe weather in February of 1989. In late April of 1989, only three varieties looked like they were worth keeping; Oneida VR, Arrow and Commandor. As shown in the table, surviving plants of some varieties did rebound, but Oneida VR and Arrow maintained their superiority.

Total forage yields over the six years were highest for Oneida VR, Arrow, DK-135, 'WL 316' and Commandor (all Vert wilt resistant) and lowest for Vernal, 'NY 8302', 'Jubilee', 'Drummor' and 'Thor' (none of which are resistant). These results stress the importance of choosing Vert wilt resistant varieties to maximize yield and stand longevity for irrigated alfalfa production in this area.

INTRASTATE ALFALFA TRIAL - SEEDED 1984
KALISPELL - IRRIGATED 1989 YIELDS

VARIETY	VERT W RESIST	STAND 4/28 %	ALFALFA YIELD t/a
Oneida VR	HR	52	2.17
Arrow	R	47	2.16
Ladak-65	--	30	1.68
Commandor	MR	42	1.65
Baker	--	17	1.52
526	--	23	1.50
Wrangler	LR	34	1.33
Beaver	--	11	1.30
DK-135	MR	13	1.26
Advantage	--	28	1.21
Iroquois	--	13	1.17
WL 316	R	23	1.16
532	--	15	1.14
Mohawk	--	26	1.05
Spectrum	--	17	1.00
Vernal	--	30	0.90
Phytor	S	33	0.89
Challenger	--	21	0.78
DK-120	--	10	0.71
NY 8302	S	7	0.62
Maxim	R	14	0.32
Decathlon	MR	8	0.26
Jubilee	--	10	0.25
Thor	--	9	0.14
Drummor	--	2	0.11
LSD(0.05)		17	0.74
P-VALUE		0.00	0.00
CV(s/mean)		47.2	42.6

Seeding date: 4/24/84
Fertilizer: 4/11/89 - P2O5 - 132 lbs/a
Pesticides: 10/28/88 - Lexone - 0.75 lb AI/a
Crop year precipitation: 23.39
Irrigation: 4 inches
Last spring frost: 5/21 (32 degrees F)
First fall frost: 9/9 (29 degrees F)

INTRASTATE ALFALFA YIELD TRIAL - SEEDED 1984 - SEEDED 1984.
KALISPELL - IRRIGATED 1984-89 YIELDS

VARIETY	VW RES	1984	1985	1986	1987	1988	1989 (1 harv)	TOTAL
		t/a						
ONEIDA VR	HR	3.72	6.93	6.10	7.96	7.91	2.17	34.79
ARROW	R	4.02	6.74	6.17	7.56	7.45	2.16	34.10
DK-135	MR	4.06	6.76	6.56	8.14	6.77	1.26	33.55
WL 316	R	3.60	6.94	6.06	7.31	7.12	1.16	32.19
COMMANDOR	MR	3.78	6.66	5.98	6.89	6.65	1.65	31.61
BAKER	--	3.94	6.44	6.01	7.34	6.31	1.52	31.56
526	--	4.04	7.32	6.08	5.87	5.50	1.50	30.31
ADVANTAGE	--	3.89	6.87	5.81	6.20	5.12	1.21	29.10
WRANGLER	LR	3.70	6.37	5.71	6.26	5.56	1.33	28.93
LADAK-65	--	3.63	6.10	5.61	5.96	5.67	1.68	28.65
IROQUOIS	--	3.81	6.98	5.88	5.78	4.82	1.17	28.44
DK-120	--	3.78	6.61	5.87	6.08	5.38	0.71	28.43
SPECTRUM	--	4.07	7.02	5.42	5.53	5.30	1.00	28.34
532	--	3.66	7.11	5.78	5.51	4.94	1.14	28.14
PHYTOR	S	3.83	6.45	5.90	5.78	4.80	0.89	27.65
CHALLENGER	--	4.04	6.79	5.60	5.51	4.93	0.78	27.65
MOHAWK	--	3.92	6.83	5.54	5.60	4.53	1.05	27.47
MAXIM	R	4.01	6.87	5.87	5.65	4.56	0.32	27.28
BEAVER	--	3.49	6.17	5.68	5.62	4.91	1.30	27.17
DECATHLON	MR	3.97	7.03	5.78	5.57	4.53	0.26	27.14
VERNAL	--	3.76	6.49	5.60	5.16	4.88	0.90	26.79
NY 8302	S	3.70	6.96	5.61	5.49	4.14	0.62	26.52
JUBILEE	--	3.86	6.28	5.41	5.51	4.56	0.25	25.87
DRUMMOR	--	4.43	6.76	5.87	4.79	3.31	0.11	25.27
THOR	--	4.07	6.76	5.56	4.76	3.45	0.14	24.74
LSD (0.05)		0.34	0.47	0.44	0.76	0.55	0.47	
P-VALUE		0.00	0.00	0.00	0.00	0.00	0.00	
CV (S/MEAN)		6.2	4.9	5.4	8.8	6.3	19.4	

Seeding date: 4/24/84
Fertilizer: Spring 1984 - P2O5 - 260 lbs/a
Fall 1986 - P2O5 - 88 lbs/a
K2O - 100 lbs/a
S - 50 lbs/a
4/11/89 - P2O5 - 132 lbs/a
Pesticides: 1984 - Eptam + 2,4-DB
7/2/86 - Imidan - 1 lb AI/a
10/14/86 - Sencor - 1 lb AI/a
10/20/87 - Sencor - 1 lb AI/a
10/28/88 - Lexone - 3/4 lb AI/a

Crop yr precip: 19.93" 17.56" 23.23" 21.97" 13.94" 23.39"

YEAR/PROJECT: 1989/755 1984 INTRASTATE ALFALFA YIELD TRIAL-DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

Percent stand was measured using a 2 x 20 square grid on 4/30/89. The varieties showing the best stand persistence over the five years were 'Pioneer 526' at 92%, 'Ladak-65' at 89%, 'Beaver' at 85%, 'Arrow' at 77%, 'Iroquois' and 'Mohawk' at 76%, and 'Phytor' and 'Decathlon' at 73%. Only two of these eight varieties have Verticillium wilt resistance, indicating that Vert wilt is less a problem in dryland than in irrigated fields. 'Jubilee' had the poorest stands (23%),but it was not significantly lower than 'DK-135' (42%) which is moderately resistant to Vert wilt.

First harvest occurred on 6/15/89. Ladak-65, Pioneer 526, Beaver, Arrow, and Mohawk had the highest yields, while Jubilee, 'Drummor', 'DK-135', 'WL 316', and 'Advantage' had the lowest. (These five lowest yielding varieties had fall dormancy ratings of 4; therefore, they may have been affected by the severe winter. The five highest yielding varieties have FD ratings of from 1-3.) Second harvest yields ranged from 2.52 t/a for Arrow to 1.46 t/a for Jubilee. At third harvest Arrow (1.46 t/a) and 'Oneida VR' (1.36 t/a) had significantly higher yields than any other variety. Drummor had the lowest yield at 0.77 t/a. Total forage yields for 1989 ranged from 6.13 t/a for Arrow to 3.04 t/a for Jubilee. Fall dormancy appeared to be a more important factor than Vert wilt resistance in this nursery. The top twelve varieties had an average FD rating of 2.3 (indicating good winter hardiness) while the bottom 12 varieties had an average FD rating of 3.7 (less winter hardy). Each group had the same number of Vert wilt resistant varieties (4). Total yields over the six years were highest for 'Pioneer 532', at 33.56 t/a, and lowest for Jubilee, with 29.69 t/a.

INTRASTATE ALFALFA TRIAL - SEEDED 1984
KALISPELL - DRYLAND 1989 YIELDS

VARIETY	VERT W RESIST	STAND 4/30 %	HARVEST-1 6/15/89 t/a	HARVEST-2 8/1/89 t/a	HARVEST-3 9/24/89 t/a	TOTAL t/a
Arrow	R	77	2.15	2.52	1.46	6.13
526	--	92	2.43	2.33	1.17	5.93
Ladak-65	--	89	2.53	2.24	0.90	5.67
Oneida VR	HR	71	1.86	2.43	1.36	5.65
Beaver	--	85	2.29	2.33	0.91	5.53
Iroquois	--	76	2.05	2.19	1.12	5.36
Commandor	MR	67	1.90	2.27	1.14	5.31
532	--	60	1.96	2.23	1.06	5.25
Wrangler	LR	56	1.78	2.27	1.11	5.16
DK-120	--	70	1.73	2.21	1.18	5.12
Phytor	S	73	2.00	2.13	0.99	5.12
Mohawk	--	76	2.07	2.05	0.98	5.10
Decathlon	MR	73	1.91	1.99	1.10	5.00
NY 8302	S	71	1.81	2.04	1.14	4.99
Challenger	--	60	1.64	2.09	1.17	4.90
Vernal	--	69	1.82	2.12	0.95	4.89
Thor	--	62	1.55	1.99	0.98	4.52
Baker	--	60	1.55	1.91	1.04	4.50
Spectrum	--	51	1.32	1.99	1.15	4.46
WL 316	R	47	1.16	2.06	1.20	4.42
DK-135	MR	42	1.14	1.91	1.20	4.25
Maxim	R	53	1.23	1.90	1.09	4.22
Advantage	--	44	1.20	1.91	1.05	4.16
Drummor	--	44	1.04	1.68	0.77	3.49
Jubilee	--	23	0.74	1.46	0.84	3.04
LSD(0.05)		20	0.48	0.31	0.16	0.82
P-VALUE		0.00	0.00	0.00	0.00	0.00
CV(s/mean)		22.3	20.0	10.6	10.6	12.0

Seeding date: 5/4/84
Fertilizer: 1989 - P2O5 - 132 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a
Crop year precipitation: 23.39"
Last spring frost: 5/21/89 (32 degrees F)
First fall frost: 9/9/89 (29 degrees F)

INTRASTATE ALFALFA YIELD TRIAL - SEEDED 1984
KALISPELL - DRYLAND - 1984-89 YIELDS

VARIETY	VERT W RESIST	1984	1985	1986 *	1987	1988	1989	TOTAL
532	--	1.20	4.96	6.88	7.59	7.68	5.25	33.56
Arrow	R	1.04	4.46	6.34	7.42	7.85	6.13	33.24
526	--	1.07	4.46	6.22	7.93	7.47	5.93	33.08
Wrangler	LR	1.23	4.88	6.79	7.42	7.33	5.16	32.81
WL 316	R	1.12	4.88	6.77	7.66	7.67	4.42	32.52
Decathlon	MR	1.12	4.59	6.29	7.72	7.72	5.00	32.44
Commandor	MR	1.10	4.47	6.28	7.76	7.41	5.31	32.33
Mohawk	--	1.14	4.62	6.51	7.92	6.90	5.10	32.19
DK-120	--	1.15	4.57	6.43	7.67	7.24	5.12	32.18
Iroquois	--	1.09	4.58	6.62	7.27	7.19	5.36	32.11
Thor	--	1.16	4.87	6.70	7.64	7.00	4.52	31.89
Spectrum	--	1.19	4.60	6.64	7.33	7.66	4.46	31.88
DK-135	MR	1.18	4.60	6.58	7.47	7.46	4.25	31.54
Oneida VR	HR	1.02	4.21	5.96	7.21	7.39	5.65	31.44
Phytor	S	1.17	4.22	6.22	7.46	7.18	5.12	31.37
Beaver	--	1.20	4.32	6.29	7.56	6.39	5.53	31.29
Ladak 65	--	1.28	4.15	6.22	7.40	6.37	5.67	31.09
Baker	--	1.23	4.50	6.31	7.33	7.04	4.50	30.91
Maxim	R	1.10	4.48	6.52	7.31	7.21	4.22	30.84
NY 8302	S	1.06	4.09	5.81	7.66	7.14	4.99	30.75
Advantage	--	1.19	4.62	6.56	7.31	6.85	4.16	30.69
Vernal	--	1.15	4.32	6.36	7.34	6.57	4.89	30.63
Challenger	--	1.16	4.32	6.01	7.30	6.92	4.90	30.61
Drummor	--	1.25	4.76	6.52	7.40	6.81	3.49	30.23
Jubilee	--	1.23	4.63	6.59	7.28	6.92	3.04	29.69
LSD(0.05)		0.30	0.25	0.39	0.65	0.58	0.82	
P-VALUE TRTS		0.00	0.00	0.01	0.71	0.00	0.00	
CV (s/mean)		7.4	18.3	9.2	6.2	5.7	12.0	

* Yields corrected due to error in size of harvest area

Seeding date: 5/4/84
Fertilizer: Spring 1984 - P2O5 - 180 lbs/a
Fall 1986 - P2O5 - 88 lbs/a
K2O - 100 lbs/a
S - 50 lbs/a
Fall 1989 - P2O5 - 132 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a
Pesticides: 1984 - Eptam - 4 lbs AI/a
7/2/86 - Imidan - 1 lb AI/a
10/14/86 - Sencor - 1 lb AI/a
10/20/87 - Sencor - 1 lb AI/a
10/28/88 - Lexone - 0.75 lb AI/a

Crop Year Precip. (in)	19.93	17.56	23.23	21.97	13.94	23.39	

YEAR/PROJECT: 1989/755 1980 INTRASTATE ALFALFA YIELD TRIAL-DRYLAND

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye

On 4/27/89 stand ratings were obtained using a 2 x 20 square grid. The varieties showing the best stand persistence over the ten years were 'Perry' and 'Spredor II', with 85% stand, 'Vernal', 'Ladak-65', 'WL 220', 'Vancor', 'Super 721' and 'Armor', with 82% to 67% of the stands remaining. 'Spectrum' had the poorest stands (48%).

First harvest was obtained on 6/14/89. Ladak-65, Perry, and Spredor II had the highest yields, while 'Marathon', 'Raidor', Spectrum and 'Thor' had the lowest. (These four lowest yielding varieties have fall dormancy ratings of 4; therefore, they may have been affected by the severe winter. The three highest yielding varieties have FD ratings of from 1-3.) Second harvest yields ranged from 1.65 t/a for Ladak-65 to 1.07 t/a for Raidor and Marathon. At third harvest 'Baker', at 1.21 t/a, had the highest yields. Spredor II (0.72 t/a) and Marathon (0.84 t/a) had the lowest. Total forage yields for 1989 ranged from 5.40 t/a for Ladak-65 to 3.39 t/a for Marathon. Total yields over the ten years were highest for Ladak-65, with 40.32 t/a, and lowest for 'Ranger', with 32.29 t/a.

INTRASTATE ALFALFA TRIAL - SEEDED 1980
KALISPELL - DRYLAND 1989 YIELDS

VARIETY	STAND 4/27 %	HARVEST-1 6/14/89 t/a	HARVEST-2 7/31/89 t/a	HARVEST-3 9/25/89 t/a	TOTAL t/a
Ladak-65	80	2.71	1.65	1.04	5.40
Perry	85	2.42	1.38	1.18	4.98
Baker	62	2.20	1.55	1.21	4.96
Armor	67	2.10	1.57	1.17	4.84
Vancor	73	2.12	1.49	1.12	4.73
Super 721	69	2.10	1.43	1.03	4.56
Cascade	56	1.91	1.36	1.17	4.44
WL 220	75	2.03	1.33	1.08	4.44
Vernal	82	2.16	1.28	0.94	4.38
Classic	73	1.97	1.31	1.09	4.37
Spredor II	85	2.37	1.28	0.72	4.37
Anchor	64	2.03	1.39	0.92	4.34
Ranger	62	1.92	1.20	0.94	4.06
Spectrum	48	1.66	1.30	0.99	3.95
Thor	49	1.76	1.12	0.95	3.83
Raidor	60	1.55	1.07	0.88	3.50
Marathon	51	1.48	1.07	0.84	3.39
LSD(0.05)	20	0.40	0.35	0.16	0.85
P-VALUE	0.00	0.00	0.06	0.00	0.00
CV(s/mean)	18.3	11.8	15.8	9.2	11.6

Fertilizer: Fall 1989 - P2O5 - 132 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a
Pesticides: 10/26/89 - Sencor - 1 lb AI/a
Crop year precipitation: 23.39"
Last spring frost: 5/21/89 (32 degrees F)
First fall frost: 9/9/89 (29 degrees F)

INTRASTATE ALFALFA YIELD TRIAL - SEEDED 1980
KALISPELL - DRYLAND 1980-1989 YIELDS

	YIELDS - t/a										
VARIETY	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
LADAK-65	1.48	4.29	2.81	3.31	3.19	4.76	4.26	5.74	5.08	5.40	40.32
VANCOR	1.81	4.48	2.51	2.98	3.41	5.59	4.44	5.82	4.54	4.73	40.31
ARMOR	1.79	4.14	2.34	2.91	3.12	5.36	4.49	6.04	4.83	4.84	39.86
BAKER	1.81	4.07	2.30	2.61	3.01	5.04	4.26	6.20	4.66	4.96	38.92
ANCHOR	1.70	4.53	2.68	2.65	3.05	5.04	4.56	5.63	4.39	4.34	38.57
SPREDOR II	1.52	4.74	2.48	3.19	3.55	5.22	4.28	5.28	3.85	4.37	38.48
THOR	1.99	4.73	2.75	2.71	3.32	5.17	4.42	5.36	3.85	3.83	38.13
SUPER 721	1.45	3.99	2.44	2.85	3.00	5.35	4.21	5.36	4.70	4.56	37.91
CASCADE	1.86	3.90	2.42	2.67	3.09	5.52	4.24	5.61	4.15	4.44	37.90
SPECTRUM	1.80	4.63	2.69	2.80	3.07	4.93	3.93	5.47	4.28	3.95	37.55
PERRY	1.67	4.06	2.38	2.43	3.18	4.79	3.86	5.24	4.79	4.98	37.38
WL 220	1.69	4.02	2.01	2.46	3.40	4.99	4.06	5.48	4.26	4.44	36.81
VERNAL	1.79	4.09	2.62	2.32	2.97	4.82	4.03	5.28	4.17	4.38	36.47
CLASSIC	1.74	3.78	2.05	2.83	2.81	4.84	4.09	5.29	4.60	4.37	36.40
RAIDOR	1.84	4.40	2.40	2.86	3.33	5.43	3.93	4.99	3.35	3.50	36.03
MARATHON	1.66	4.07	2.39	2.44	2.86	4.52	3.53	4.83	3.27	3.39	32.96
RANGER	1.34	3.38	2.32	2.34	2.41	4.20	3.50	4.69	4.05	4.06	32.29
LSD(0.05)		0.49	0.72	0.61	0.92	1.26	0.86	0.83	0.86	0.85	
P-VALUE		0.00	0.73	0.08	0.78	0.78	0.49	0.06	0.01	0.00	
CV(s/mean)		8.3	20.8	15.8	20.9	17.5	14.7	10.8	12.1	11.6	

FERTILIZER: Spring 1980 - P2O5 - 132 lbs/a
Fall 1981 - P2O5 - 52 lbs/a
Spring 1984 - P2O5 - 90 lbs/a
K2O - 50 lbs/a
S - 40 lbs/a
Fall 1986 - P2O5 - 88 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a
Fall 1989 - P2O5 - 132 lbs/a
K2O - 120 lbs/a
S - 50 lbs/a

HERBICIDES: 1980 - Eptam + 2,4-DB
Fall 1984,1986,1987 - Sencor - 1 lb AI/a
Fall 1988 - Lexone - 0.75 lb AI/a
10/26/89 - Sencor - 1 lb AI/a

Crop Year										
Precip(in)	23.6	23.7	18.2	21.0	19.9	17.6	23.2	22.0	13.9	23.39

YEAR/PROJECT: 1989/755 IRRIGATED GRASS STUDY
SEEDED 1987

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with John Scheetz, PMS - Bridger, MT

Harvest areas were measured, and the mean of each replication was used to calculate yield of each plot in that rep. Nitrogen was applied at 136 lbs/a on 4/12/89. On 8/14/89 2,4-D ester was applied at 1 lb AI/a for broadleaf weed control. The nursery was irrigated twice this season.

'Latar' orchardgrass and 'Regar' meadow brome had significantly higher first harvest yields than the other species. 'Shoshone' beardless wild rye had significantly lower yield than any other species. For second harvest 'Jose' tall wheatgrass had significantly higher yield, and 'Slender' wheatgrass had significantly lower yield than any other species. At third harvest Regar and 'Kenmont' tall fescue had the highest yields, while Jose dropped into last place. Kenmont and Latar yielded the most at fall harvest, and Slender had insufficient regrowth for cutting. The highest total 1989 yields were 8.12 t/a for Latar and 8.07 t/a for Regar. These two species also had the highest total yields for 1988 and 1989 combined. Slender and Shoshone had the lowest total yields - less than half that of Latar.

IRRIGATED GRASS STUDY - KALISPELL, 1989
SEEDED 1987

SPECIES	First Harvest 5/30/89	Second Harvest 7/6/89	Third Harvest 8/3/89	Fourth Harvest 10/2/89	Total 1989	Total 1988-89
	YIELD (t/a)					
Latar Orchardgrass	3.65	1.68	1.21	1.58	8.12	13.08
Regar Meadow Brome	3.76	1.42	1.42	1.47	8.07	12.38
Kenmont Tall Fescue	2.70	1.67	1.47	1.64	7.48	10.57
Jose Tall Wheatgrass	1.89	1.91	0.21	0.23	4.24	7.63
Garrison Creeping Foxtail	3.29	1.14	0.73	0.92	6.08	7.42
Slender Wheatgrass	2.25	0.68	0.49	0.00	3.42	6.02
Shoshone Beardless Wild Rye	1.30	1.40	0.52	0.49	3.71	4.82
LSD(0.05)	0.25	0.17	0.15	0.16	0.40	2.43
P-VALUE	0.00	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	6.3	7.8	11.5	11.9	4.6	18.5

Seeding date: 11/5/87
Crop year precipitation : 23.39"
Fertilizer: 4/6/88 - N - 70 lbs/a
5/6/88 - N - 70 lbs/a
P - 150 lbs/a
4/12/89 - N - 136 lbs/a
Herbicide: 8/14/89 - 2,4-D ester - 1 lb AI/a
Irrigation: 6/27 - 2"
7/26 - 2"
Last spring frost: 5/21 (32 degrees F)
First fall frost: 9/9 (29 degrees F)

YEAR/PROJECT: 1989/755 EVALUATION OF TEFF (ERAGROSTIS TEF) AS A FORAGE AND GRAIN CROP IN MONTANA.

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Joyce Eckhoff, Sidney

This study was undertaken to determine if Teff, a warm season annual grass used as a food grain in Ethiopia and a hay crop in parts of Africa, can be grown in Montana. Six lines of this species, selected for early maturity, lodging resistance and biomass, were seeded on 5/17/89 on dryland in a randomized complete block design with 4 replications. Plots consisted of 4 ten foot rows spaced one foot apart with 2 feet between plots. The two center rows of each plot were harvested for hay yield on 7/25/89, when the grass was just starting to head. An additional hay harvest was cut on 9/13. The two outside rows were harvested for grain yield on 9/24/89 when the heads had turned brown. Samples of hay and seed were saved for quality analysis.

The grass emerged within 17 to 20 days after seeding. On 6/28 stand was recorded. SD100, with 92%, had significantly better stand establishment than the other lines (71-80%). The grass started heading between 61 and 66 days after seeding. On 7/25 the first hay harvest was cut. MT177, MT241, and MT247 had the highest yields (1.61, 1.72, and 1.67 t/a respectively), and MT66 had the lowest yield (1.18 t/a). Yields for the second forage harvest on 9/13 ranged from 1.69 to 2.21 t/a but were not significantly different from each other; neither were the totals of the two harvests (3.24 - 3.63 t/a). Seed was harvested on 9/24. SD100 had significantly higher yield than any other line (1771 lbs/a). MT66, with only 200 lbs/a, had by far the lowest yield. From this data it appears that any of these five lines could produce a respectable amount of forage in this area with a 2-cutting system, but the lines differ dramatically in their production of grain.

TEFF VARIETY TRIAL - KALISPELL, MT
Seeded 1989

VARIETY	6/28 STAND %	7/25/89 HT in	7/25/89 YIELD t/a	9/13/89 HT in	9/13/89 YIELD t/a	TOTAL FORAGE YIELD t/a	SEED YIELD lbs/a
MT177	78	25	1.61	29	2.02	3.63	1217
MT241	71	28	1.72	33	1.79	3.51	1203
MT247	75	25	1.67	32	1.81	3.48	914
MT66	80	22	1.18	32	2.21	3.39	200
MT123	76	22	1.27	29	2.03	3.30	1052
SD100	92	23	1.55	31	1.69	3.24	1771
LSD(0.05)	12	2	0.32	2	0.41	0.56	276
P-VALUE	0.03	0.00	0.01	0.03	0.12	0.74	0.00
CV(s/mean)	10.2	4.9	14.1	5.2	14.0	11.0	17.3

Seeding date: 5/17/89
Crop year precipitation: 23.39"
Fertilizer: 4/28/89 - P2O5 - 30 lbs/a
N - 100 lbs/a
Last spring frost: 5/21/89 (32 degrees F)
First fall frost: 9/9/89 (29 degrees F)

PROJECT TITLE: Spring Barley Variety Evaluations

YEAR/PROJECT: 1989/756

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT.

SUMMARY:

Excellent yields and fair test weights wee obtained from the 1989 Intrastate nursery with all but three varieties yielding above 90 bu/A. No yield was obtained from the Early Yield nursery due to severe lodging and sprouting. Only one offstation spring barley nursery was harvested this year (Ravalli Co., Corvallis, MT) with the other being destroyed by hail.

RESULTS:

1989 Intrastate Spring Barley Nursery -

The mean yield for this nursery was 98.73 bu/A which was about eight bushel less than the mean of last year. Several varieties yielded above 100 bushel/acre, as did the check variety Gallatin at 102.24 bu/A. Test weights were less than the average mean for this nursery with the average for this test being 48.97 lbs/bu. Heading was about four days later than last year. Lodging was prevalent this year due to the high rain rain fall at harvest time. Table 1.

1989 Early Yield Trial -

Severe lodging contibuted towards a high percentage of sprout in this nursery so yields were not taken. Height, heading, and lodging data were obtained. Table 2.

Ravalli Co. Offstation -

Yields and test weights were good for this location with some shattering contributing to yield loss. Yields ranged from 105 to 59 bushel per acre and test weights averaged 48.3 lbs/bushel. Height was a little less than previous years and percent plump was average for the location. Moravian 3 barley had the lowest percent plump at 84.6%. Table 3.

Table 1. Agronomic data from the Intrastate Spring barley grown on the Northwestern Agricultural Research Center in 1989.

Date planted: April 7, 1989 Harvested: August 18, 1989

VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEAD DATE	LODGING PREV	LODGING SEV
CO 89-3	112.47	47.83b	89.70	25.85b	176.33a	.00	.00
BA 8529 2B82-8529	112.10	49.97b	96.40	30.97b	171.67	5.00	1.00
MT861183 WA 890878/MENUET	110.79	50.00b	95.50	31.10b	171.67	3.33	.67
CO 89-1	110.23	50.03b	92.90	34.51	175.67a	38.33	4.33
CO 89-4	108.23	49.37b	95.50	27.69b	178.67a	.00	.00
MT860326 LEWIS/TR 533	107.62	50.73	94.50	33.46	169.67	33.33	3.33
MT 81616 TR440/CLARK	107.54	47.10b	91.50	33.86	173.33a	56.67	4.67
MT 81502 Clark//Kgs/Zy	106.67	49.87b	95.50	32.28	170.00	10.00	1.00
MT860224 LEWIS/APEX	106.62	49.73b	94.80	32.02b	172.67	10.00	1.33
MT 81161 Lewis//Kgs/Smt	105.14	48.47b	91.90	32.41	170.00	65.00a	5.33a
SK 76333 HARRINGTON	104.60	49.40b	92.30	33.07	172.67	46.67	5.33a
MT870120 LINDY/MARTIN	104.51	45.93b	96.50	32.55	169.33	31.67	1.67
MT 83435 CLARK/TR450	104.50	50.10b	94.70	31.76b	172.33	.00	.00
MT851051 HARRINGTON/MT 41921	104.04	50.00b	95.80	34.91	172.33	13.33	2.33
MT851013 CLARK/WA877178	103.64	48.03b	92.20	33.73	174.00a	55.00	3.67
MT 83422 CLARK/TR450	103.33	49.73b	93.10	32.02b	173.00a	3.33	.67
MT870056 COLUMBIA/BA 26	103.22	44.50b	87.30	33.07	171.00	13.33	2.67
MT851161 MT 41918/MT 41279	103.01	48.93b	91.80	32.81	170.00	66.00a	5.33a
MT870109 ID 76871/GALLATIN	102.84	50.43	91.80	33.33	171.33	73.33a	5.00a
CI 15478 KLAGES	102.45	47.43b	83.40	33.99	177.67a	50.00	5.00a
PI491534 GALLATIN /1	102.24	51.77	95.70	35.17	170.00	16.67	1.33
MT851032 HARRINGTON/CLARK	102.15	49.73b	94.70	32.28	173.33a	25.00	2.33
CI 15229 STEPTOE	101.97	45.23b	95.10	33.73	169.33	53.33	3.67
MT861626 GALLATIN/HARRINGTON	101.34	50.83	95.20	33.99	175.33a	30.00	2.67
CO 89-2	101.26	51.00	97.20	33.86	171.00	16.67	2.33
MT861572 LEWIS/MT 41549	100.90	50.47	92.80	34.91b	171.33	36.67	1.50
MT851177 MT 41918/BRIDGER 82	100.76	49.23b	95.40	31.10b	171.33	11.67	2.67
MT860219 LEWIS/APEX	100.60	49.80b	95.30	30.84b	172.00	3.33	.67
MT 83533 CLARK/LAMONT	100.41	49.23b	96.30	31.63b	170.00	16.67	2.67
NS 77021 Princesse	100.22	47.83b	97.10	28.08b	175.33a	.00	.00
MT851011 CLARK/WA877178	100.21	48.80b	92.00	31.89	174.00a	8.33	1.67
MT851005 CLARK/ID 810264	99.63	48.00b	93.30	34.51	170.33	63.00a	5.33a
NS 78054 Baronesse	99.26	48.43b	96.00	30.58b	174.00a	53.00	5.00a
PI483127 RUSSELL	98.48	48.03b	96.50	32.81	168.67	.00	.00
MT860839 SUNBAR 560/MT 41549	98.25	49.13b	93.70	30.05b	169.67	.00	.00
MT860463 HARRINGTON/APEX	97.96	49.40b	95.70	29.66b	172.00	3.33	1.33
MT 81143 Hcr/Kgs//Kgs/Smt	97.89	51.57	96.40	33.60	170.67	3.33	1.00
CI 15856 LEWIS	97.71	50.53	94.00	33.33	170.00	13.33	2.00
AC 1798 Steffi	97.60	48.70b	98.70	30.84b	177.00a	8.33	3.00
MT140523 HECTOR/KLAGES	97.50	50.73	95.10	33.60	170.00	35.00	3.33
MT851012 CLARK/WA877178	96.77	48.10b	90.40	33.33	171.67	82.67a	5.00a
MTSU 247 WANUBET LR247	96.66	50.73	83.20	35.83	174.33a	88.00a	7.67
MT851195 MT 41918/TR 450	96.21	49.33b	93.00	32.94	169.67	8.33	1.00
MT870031 BA79533/LEWIS	95.96	49.07b	91.50	33.73	170.67	16.67	2.33

Table 1. (Cont'd)

	VARIETY	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEAD DATE	LODGING PREV	LODGING SEV
MT851088	MT354585/MT 4126	95.38	49.67b	95.20	34.38	170.00	58.33a	4.33
MT870137	MINERVA MUTANT/CLARK	95.09	47.33b	98.90	31.36b	172.67	53.00	4.33
CI 9558	PIROLINE	94.89	50.03	93.10	35.17	170.33	69.67a	7.00a
MT870160	MOREX/ROBUST	93.95	48.57b	96.60	43.04a	169.33	31.67	3.00
MT870105	HAZEN/UT1423	93.31	47.07b	98.20	37.80	169.33	3.33	1.00
MT861596	Lewis/MT 41549	93.19	50.70	84.70	32.68	170.33	41.67	3.67
MT851216	ID810264/MT 4126	93.05	49.03b	97.00	32.41	170.00	16.67	2.00
MT860737	GALLATIN/APEX	92.75	51.27	97.20	30.71b	171.67	.00	.00
MT870098	HAZEN/AZURE	92.64	46.83b	96.00	37.53	169.33	6.67	1.67
BA 2601		91.95	47.53b	94.60	29.79b	171.67	.00	.00
MT851224	ID810264/MT41918	91.66	48.33b	92.50	33.99	173.33	65.00a	5.00a
MT870216	ROBUST/BRIGGS	91.30	47.33b	96.10	38.06	169.00	.00	.00
CI 15857	CLARK	90.57	48.17b	93.00	32.94	174.00	68.00a	6.00a
MT851031	HARRINGTON/CLARK	90.42	49.30b	93.70	33.60	172.33	55.00	4.67
MT870136	MINERVA MUTANT/CLARK	90.32	49.50b	94.10	30.84b	172.33	58.33a	6.00a
CI 15514	HECTOR	90.25	48.77b	88.90	32.68	171.33	96.00a	6.33a
MT870012	APEX/LEWIS	89.93	49.03b	92.60	30.58	173.33	25.00	2.33
MT870100	HAZEN/CHALKY GLENN	82.88b	46.57b	87.90	36.61	169.00	3.33	1.00
MN 36	ROBUST	81.23b	48.40b	97.40	37.14	170.33	3.33	.67
CI 15773	MOREX	78.59b	47.23b	95.90	40.81a	168.67	60.00a	2.33

	YIELD BU/A	TEST WT LB/BU	% PLUMP	HEIGHT INCHES	HEAD DATE	LODGING PREV	LODGING SEV
EXPERIMENTAL MEANS	98.73	48.97	.00	33.12	171.77	29.42	2.71
F TEST FOR REPS.	31.49	1.96	.00	104.41	18.13	28.93	38.16
F TEST FOR VAR. 2/	1.57*	8.87**	.00	7.03**	5.15	3.37**	2.54**
C.V. 2: (S OF MEAN/MEAN)	5.66	1.02	.00	3.17	.59	50.33	47.38
LSD (0.05)	15.64	1.40	.00	2.93	2.83	41.44	3.59

1/ Check variety (Gallatin)
2/ F value for variety comparison
* Indicates statistical significance at the .05 level of probability
** Indicates statistical signifciance at the .01 level of probability
a/ Values significantly higher than the check at the .05 level
b/ Values significantly less than the check at the .05 level

Table 2. Agronomic data from the Early Yield spring barley nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT. in 1989.

Planted: April 12, 1989 No harvest taken due to severe lodging

	VARIETY	HEIGHT INCHES	HEAD DATE	--LODGING-- PREV	SEV	HEIGHT CM
CI 15773	Morex	47.64	172.67	99.00	8.33	121.00
MT883603	Hazen/Robust	46.33	174.00	94.33	8.00	117.67
MT880001	Hazen/Morex	46.06	172.33	91.33	7.67	117.00
MT880103	Hazen/Unitan	45.41	171.33	94.67	7.67	115.33
MT881809	Columbia/Hazen	44.49	173.33	13.33	4.33	113.00
MT880008	Hazen/Morex	44.23	172.00	88.00	7.67	112.33
MT889502	Bowman/Unitan	43.44	169.67	99.00	8.00	110.33
MT888009	Robust/ID 789009	43.18	172.33	55.00	5.67	109.67
MT851145	WA 890878/MT41238	42.78	176.67	99.00	8.33	108.67
MT886705	MT 81143/UT 1423	42.78	169.67	.00	.00	108.67
MT850053	Clark/ND5976	42.65	174.00	99.00	7.67	108.33
MT888010	Robust/ID 789009	42.13	175.00	66.33	7.33	107.00
MT884201	Lewis/ID789009	41.86	175.00	73.00	7.00	106.33
MT887603	MT 81619/UT 1423	41.86	177.00	99.00	8.33	106.33
MT883705	ID 76871/Chalky Glenn	41.60	172.00	76.33	7.67	105.67
MT884806	Minerva Mutant/Gallatin	41.60	173.00	69.67	8.00	105.67
MT881805	Columbia/Hazen	41.34	177.00	68.00	6.33	105.00
MT887510	MT 81619/Lewis	41.34	172.67	99.00	8.00	105.00
MT851425	MT 51549/Lewis	41.08	176.00	99.00	8.00	104.33
MT851432	MT 51549/Lewis	41.08	178.67	99.00	8.33	104.33
MT880903	BA 27937/Chalky Glenn	41.08	171.00	99.00	8.00	104.33
MT889102	Apex/Lewis	40.94	169.67	99.00	8.33	104.00
MT887006	MT 81502/UT 1423	40.81	175.67	58.33	6.33	103.67
MT880503	Azure/UT 1423	40.68	173.00	58.33	7.00	103.33
MT887406	MT 81619/Chalky Glenn	40.68	171.67	36.67	4.33	103.33
CI 15856	Lewis	40.55	172.67	99.00	8.00	103.00
MT880301	Azure/Chalky Glenn	40.29	169.33	59.67	5.00	102.33
MT850661	Harrington/Bridger	40.16	179.00	88.33	8.00	102.00
SK 76333	Harrington	40.03	178.33	99.00	7.67	101.67
MT880508	Azure/UT 1423	40.03	169.67	84.67	8.00	101.67
CI 15514	Hector	39.89	174.67	99.00	8.33	101.33
MT887509	MT 81619/Lewis	39.89	174.33	99.00	8.00	101.33
MT851342	MT 41238/ND 5698	39.76	177.67	97.67	7.67	101.00
CI 15229	Steptoe	39.76	170.33	99.00	8.00	101.00
MT882004	Columbia/Lindy	39.50	171.67	45.00	6.67	100.33
MT888205	Steptoe/Chalky Glenn	39.24	170.00	86.00	7.00	99.67
PI483127	Russell	39.24	170.67	73.00	7.00	99.67
MT880802	MT 41918/Robust	39.11	170.33	35.00	3.67	99.33
MT881409	Columbia/Azure	38.98	171.67	20.00	3.00	99.00
MT886610	MT 81143/Lewis	38.98	176.00	69.67	6.33	99.00
MT886609	MT 81143/Lewis	38.71	172.67	89.33	8.00	98.33
MT885603	Minerva Mutant/TR 215	38.71	180.00	97.67	8.00	98.33

Cont'd on next page

Table 2. (Cont'd) Agronomic data from the Early Yield spring barley nursery

VARIETY	HEIGHT INCHES	HEAD DATE	--LODGING-- PREV	SEV	HEIGHT CM
MT887104 MT 81535/Lewis	38.71	176.33	99.00	8.33	98.33
MT889003 Apex/Clark	38.71	175.67	97.67	7.67	98.33
MT882307 Fleet/UT 1423	38.58	176.67	78.33	8.00	98.00
MT888803 VDH 130-78/UT 1423	38.58	176.33	71.33	7.67	98.00
MT882604 Gallatin/Premier	38.32	172.00	76.67	6.33	97.33
CI 15478 Klages	38.32	179.67	96.00	8.00	97.33
MT888407 TR 215/ID 789009	38.19	179.33	89.67	8.00	97.00
MT882208 Fleet/Lewis	38.19	178.67	99.00	8.00	97.00
MT885309 Minerva Mutant/MT 81143	37.93	170.00	89.67	7.67	96.33
MT885701 Minerva Mutant/VDH 130-7	37.93	175.33	96.00	8.00	96.33
MT888709 VDH 130-78/Premier	37.66	177.67	94.67	8.00	95.67
MT888602 VDH 130-78/Lewis	37.53	172.67	54.67	6.67	95.33
MT882603 Gallatin/Premier	37.53	173.33	99.00	8.00	95.33
MT883104 Harrington/Gallatin	37.53	178.00	91.33	7.67	95.33
MT889106 Apex/Lewis	37.14	169.67	91.33	8.00	94.33
MT886601 MT 81143/Lewis	36.75	176.00	88.00	8.00	93.33
MT886707 MT 81143/UT 1423	36.48	179.00	66.67	7.33	92.67
MT887103 MT 81535/Lewis	36.35	173.33	99.00	8.33	92.33
MT883306 Hazen/Gallatin	35.96	171.00	.00	.00	91.33
MT888909 Apex/Andre	35.83	178.67	82.67	7.67	91.00
MT885702 Minerva Mutant/VDH 130-7	33.99	175.00	96.00	8.00	86.33
MT888805 VDH 130-78/UT 1423	32.41	175.00	46.33	5.67	82.33
EXPERIMENTAL MEANS	39.98	174.12	79.33	7.12	101.54
F TEST FOR REPS.	12.70	1.47	5.26	2.19	12.70
F TEST FOR VAR.	9.73	10.21	4.46	3.97	9.73
C.V. 1: (S/MEAN)*100	3.93	.96	26.30	21.23	3.93
C.V. 2: (S OF MEAN/MEAN)*100	2.27	.55	15.18	12.26	2.27
LSD (0.05)	2.54	2.69	33.71	2.44	6.45

Table 3. Agronomic data from the offstation spring barley nursery grown at the Western Research Center, Corvallis, MT in 1989 (Ravalli Co.)

Planted : April 17, 1989 Harvested: August 17,1989

VARIETY	YIELD BU/A	TEST WT LB/BU	HEIGHT IN	% PLUMP
CI 15514 Hector	105.06	50.40	25.46	96.00
PI 49476 Samson	103.54	46.63b	23.36	95.80
CI 15857 Clark	98.54	49.33b	24.28	95.40
BA 1202 Busch Agr 1202	90.07	49.50b	24.67	94.50
CI 10083 INGRID 1/	89.02	50.93	21.78	97.00
MT140523 Hector/Klages	81.94	49.73	22.57	92.40
PI483127 Russell	81.14	47.63b	21.78	90.00
PI491534 Gallatin	77.61	50.23	22.31	95.10
CI 15687 Kimberly	76.64	48.00b	23.62	94.20
CO 3 Moravian 3	76.26	49.67	20.87	84.60
CI 15856 Lewis	74.38	49.90	22.31	95.60
MT 81616 TR440/Clark	73.75	48.37b	21.39	97.00
CI 15773 Morex	69.99	47.10b	27.17	96.20
SK 76333 Harrington	67.42	47.80b	21.78	93.80
CI 15478 Klages	65.71	47.47b	22.70	93.50
MT 81161 Lewis//Kgs/Smt	65.34	47.33b	21.65	93.40
CI 15229 Steptoe	65.22	45.37b	20.47	96.40
VD 3 MENUET	63.92	48.07b	20.21	92.50
WPB 999 Winchester	60.10	46.17b	17.06	95.70
BA 2601 Busch Agr Res 2601	59.38	46.37b	21.00	93.00
EXPERIMENTAL MEANS	77.25	48.30	22.32	.00
F TEST FOR VAR. /2	1.56	12.39**	1.60	.00
C.V. 2: (S OF MEAN/MEAN)*100	14.32	.93	7.58	.00
LSD (0.05)	31.68	1.29	4.84	.00

1/ Check variety (Ingrid)
2/ F value for variety comparison
** Indicates statistical significance at the .01 level of probability
b/ Values significantly less than the check

PROJECT TITLE: Uniform Northwestern Oat Nursery

YEAR/PROJECT: 1989/756

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT.

SUMMARY:

Excellent yields and fair test weights were obtained form the 1898 Uniform Oat Nursery grown in Kalispell this year. All other agronomic components were average for this location with a light amont of lodging showing up in eight varieties.

RESULTS:

Yields for the 1989 entries were equal to the previous growing season. The mean for this year (186.74 bu/A) was just 2.93 bushels less than last year. A new entry (83AB3250) yielded the highest at 232.57 bu/A with a test weight of 34.37 lbs/bu. A new variety to watch is 83AB3119 which yielded 209.54 bu/A. The test weight was not above the mean for the trial. Trucker had the highest test weight again this year. Although Trucker has the highest test weight the yield was disappointing (the lowest yielding entry for 1988 at 149.55 bu and one of the lowest in 1989 at 159.66). Test weights were low on the average (34.46 lbs/bu mean). Heading dates were later this season by about nine days compared to last year. Although lodging was minimal there were some varieties that were effected especially by the late season rains. See table 1.

Table 1. Agronomic data from the Uniform Spring Oat Nursery grown on the Northwestern Agricultural Research Center in 1989.

Planted: April 12, 1989 Harvested: August 25, 1989

	VARIETY	YIELD BU/A	TEST WT LB/BU	HEAD DATE	HEIGHT INCHES	LODGING PREV	LODGING SEV
83AB3250	Cayuse/Monida	232.57a	34.37b	182.33a	33.86b	.00	.00
ID815792	74Ab2608/Cayuse	215.74a	35.73b	177.67b	36.88b	.00	.00
83AB3119	Cayuse/76Ab6843	209.54	34.20b	180.00	28.74b	.00	.00
ID 75861	Cayuse/Otana	205.73	35.40b	180.00	37.27b	.00	.00
ID 82248	Cayuse/Monida	203.85	33.90b	182.33a	32.15b	.00	.00
CI 9297	Appaloosa	202.19	32.17b	180.67a	36.61b	10.00	3.00
ID805807	74AB2608/Cayuse	201.01	35.03b	179.33	34.65b	.00	.00
ID805322	Border74AB1956	201.00	35.07b	181.33a	30.18b	.00	.00
CI483126	Monida (ID 751170)	200.93	34.57b	180.00	41.73b	25.00	2.33
ID821142	74ab1952/74ab2608	199.06	34.80b	179.00	29.00b	.00	.00
ID 80988	74AB1952/74AB2608	196.43	33.77b	179.00	29.13b	.00	.00
OT 308	Calibre	195.78	37.07	179.00	46.19b	11.67	4.67a
ID742608	Cayuse/Otana	192.14	34.80b	181.67a	34.51b	.00	.00
W 80474	Riel (RL 3057/Otana)	191.70	36.60	178.67	42.91b	.00	.00
CI467882	Border	189.26	33.83b	180.33	35.83b	.00	.00
ID821178	74AB1952/75AB1576	188.11	35.13b	178.00b	29.27b	.00	.00
83AB3725	74Ab1952/74Ab2608	185.25	35.87b	179.33	31.10b	.00	.00
W 78286	Dumont	184.70	36.67	179.00	43.96b	13.33	5.00a
CI 9252	Otana 1/	183.18	38.03	179.33	45.14	1.67	2.67
W 82056	Robert (OT 212/RL 30	176.88	35.10b	180.00	41.60b	.00	.00
CI 9401	Ogle	173.66	33.73b	177.67b	38.19b	.00	.00
CI 8263	Cayuse	173.07	32.63b	178.67	39.50b	31.67a	6.00a
ID804725	Cayuse/74/AB1956	172.99	35.43b	179.67	29.53b	.00	.00
ND820603	Froker/RL 3038/2/Hud	171.87	37.40	178.67	35.83b	.00	.00
NPB86801	Ogle/OT 32-15, Sel.	171.07	30.83b	182.00a	26.90b	.00	.00
CI 6611	Park	167.33	34.73b	180.00	43.70b	28.33a	5.33a
SD810109	Trucker (Moore//Dal/	159.66	40.10a	177.67b	43.04b	3.33	1.67
NP871742	Ogle/OT 32-15, Sel.	156.26	29.17b	183.33a	24.80b	.00	.00
NPB86586	Ogle/OT 3215 Sel. 85	152.39	29.20b	179.33	24.67b	.00	.00
NPB86575	Ogle/OT 32-15, Sel.	148.83b	28.40b	180.67a	25.33b	.00	.00
EXPERIMENTAL MEANS		186.74	34.46	179.82	35.07	4.17	1.02
F TEST FOR REPS.		131.84	40.23	2.74	59.08	.63	.16
F TEST FOR VAR. 2/		2.99**	18.55**	12.50**	65.67**	1.17	1.98*
C.V. 2: (S OF MEAN/MEAN)*100		6.07	1.74	.23	2.29	199.21	131.74
LSD (0.05)		32.06	1.69	1.17	2.28	23.50	3.81

1/ Check variety (Otana)
2/ F value for variety comparisons
* Indicates statistical significance at the .05 level of probability
** Indicates statistical significance at the .01 level of probability
a/ Values significantly greater than the check at the .05 level
b/ Values significantly less than the check at the .05 level

PROJECT TITLE: Spring Wheat Variety Trials

YEAR/PROJECT: 1989/756 Small Grains Production

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialists, NWARC, Kalispell, MT.

SUMMARY:

Spring wheat yields were very good this year and did not suffer greatly due to late season rains except for minor sprouting. Yields averaged above 100 bu/A in the Advanced Yield nursery and 96.24 bu/A in the Western Regional nursery.

Offstation data was obtained from Ravalli Co. test however the Lake Co. nursery was hailed out.

Triticale yields were higher than last year with the majority of test weights being greater than 50 lb/bu.

RESULTS:

1989 Western Regional Spring Wheat Nursery -

Yields were very good this year in the Western Regional Spring Wheat Nursery. The high yielding variety, UT613960, yielding 114.5 bushel per acre. Twelve of the thirty-six varieties yielded above 100 bushel and Owens, the check variety yielded 109.73 bu/A. Tests weight were lower due to the effect of heavy late season rains which also contributed to sprouting. The mean test weight was 56.43 lbs/bu, with 51 lbs/bu and the highest was 60.7 lbs/bu (OR 487400). Heading date averages were later this season by almost six days. Table 1.

1989 Advanced Yield Nursery -

The yields for the Advanced Yield nursery were very good this year as they were last year. Owens had the highest yield (104.7 bu/A) and last year was second highest at 129.08 bu/A. The mean yield for the nursery was 2.7 bu/A higher than in 1988 season. Test weights were not as high as last year, probably as a result of the rains at harvest time. This also caused some sprouting. Heading was five and one half days later than last year. Lodging was minimal yet did occur in some of the taller varieties. Table 2.

1989 Ravalli County Offstation Spring Wheat Nursery -

Yields for this nursery were better than last year, yet still were not as good as previous years. Thin stands and less than ideal growing conditions were factors contributing to such variation in yields. Test weights were not as drastic as expected and averaged 58.24 lbs/bu. Table 3.

1989 Triticale Variety Nursery -

Yields were very good this year in the Triticale nursery with the majority of varieties yielding above 65 bu/A (based on 60 lb/bu standard test weight). Test weights were also slightly higher this year in comparison to the 1988 data. No diseases were observed on the varieties and there was no lodging.

Table 1. Agronomic data from the 1989 Western Regional Spring Wheat Nursery grown on the Nothwestern Agricultural Research Center, Kalispell.

Date seeded: April 12, 1989 Date harvested: September 12, 1989

	VARIETY	Yield Bu/A	Test Wt lbs/bu	Heading Date	Height Inches
UT613960	RICK/UT 78S 147-125	114.45	52.10b	178.00a	35.96
UT 884	WYNNE/CA 353	113.45	58.73a	173.33	31.23b
CI 17904	OWENS /1	109.73	56.73	175.33	37.14
UT 817	WYNNE/CA 353	107.03	57.90	175.00	32.41b
ID 415	STERLING/BLISS	105.22	58.53a	176.33	37.80
ID 379	ID 190/ID138B	104.15	53.83b	175.00	34.12b
OR487503	EMU SIB/TJB 84/1543	103.45	55.50	179.00a	34.38b
ID 417	ID 182/FIELDWIN	102.80	58.67a	172.33b	33.99b
UT 743	WYNNE/CA 353	102.43	57.93	178.33a	33.20b
ORS 8510	MINIVET.S,CM37705K	101.38	57.30	175.00	32.15b
WA 7176	K78504/K74129-33//K7	100.83	54.73b	177.67a	36.09
CI 17903	MCKAY	100.77	58.07	177.67a	34.51b
ID 366	BRH/3/II-60-101//TZP	98.13	59.03a	173.67	35.56
WA 7326	K7205078/CI14193,S65	97.88	57.67	177.33	34.78
ID 369	A76102S-1-2/ID 134	97.78	59.10a	175.67	35.43
ID 420	A7612S-2/A75141S-2-1	96.78	58.57a	176.00	31.63b
ID 367	A76102S-1-2/ID 134	95.48b	58.10	176.00	33.73b
WA 7075	K73579/BORAH	94.95b	55.47	174.67	32.28b
WA 6920	PENAWAWA	94.73b	52.83b	177.00	32.15b
ID 341	COWBIRD"S"/5/MC/BJ06	94.15b	57.37	178.67a	30.71b
OR487570	EMU SIB/TJB 84/1543	94.10b	55.00b	178.33a	32.68b
OR487400	SN64/HN4//REX/3/EDCH	93.75b	60.70a	176.67	33.33b
WA 7493	HDM 4/NK 751 S82-62	93.38b	57.00	171.67	31.36b
OR487456	CT.S	93.07b	58.60a	173.33b	30.45b
OR487316	SAP SIB/MON SIB	92.90b	51.33b	176.33	30.58b
OR487355	JUP/BJY.S//DOVE.S	92.10b	58.20	174.33	32.15b
WA 7183	K78504/K79129-33//K7	91.98b	51.77b	177.67a	31.89b
ID 416	A73249S-11331-1/VEER	91.57b	54.83b	179.00a	34.25b
UT580646	UT77W1054-1777/906R	90.90b	56.53	175.67	30.97b
UC 638	SERRA	90.03b	57.17	173.00b	32.02b
WA 7496	K7400315/PTM70S.47	89.95b	50.93b	174.33	34.91
UT 2464	UT 78S 147-209/906R	89.72b	57.33	178.67a	33.99b
NKF 8022	KLASIC	84.92b	53.97b	169.33b	26.38b
ID 419	ID 204/ID 134	84.13b	58.67a	175.00	33.99b
CI 4734	FEDERATION	79.42b	55.60	179.00a	45.54a
OR487475	AGA/6*'YR'	77.03b	55.70	171.67b	25.72b
EXPERIMENTAL MEANS		96.24	56.43	175.72	33.32
F TEST FOR VAR.		2.90**	18.16**	10.65**	15.13**
C.V. 2: (S OF MEAN/MEAN)*100		5.12	1.02	.42	2.52
LSD (0.05)		13.89	1.63	2.07	2.37

1/ Check variety (Owens)

** Indicates statistical significance at the .01 level

a/ or b/ Values significantly greater (a) or less (b) than check at .01 level

Table 2. Agonomic data from the 1989 Advanced Yield Spring Wheat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT

Data Seeded: April 12, 1989 Date Harvested: September 13, 1989

	VARIETY	Yield Bu/A	Test Wt Lbs/bu	Heading Date	Height Inches	-- Lodging -- Prev/1	Sever/2
CI 17904	OWENS /3	140.70	57.07	177.67	36.09	.00	.00
WB LAKER	WESTBRED LAKER	123.38b	60.73a	180.00a	35.70	.00	.00
MT 8836	MT7648/ANTIZANA	122.13b	60.20a	178.00	37.14	.00	.00
WA 6920	PENAWAWA	118.37b	58.00	178.33	33.07	.00	.00
MT 8841	MT7648/MT7746	118.13b	60.07a	177.33	35.70	.00	.00
MT 8182	YDING "S"/PCI "S"-287	117.00b	56.57	174.67b	33.86	.00	.00
MT 8846	MT7648/MT7746	115.13b	58.67a	175.33	35.17	.00	.00
MT 8608	NEWANA/MT7746	114.48b	60.70a	176.00	37.66	.00	.00
MT 8845	MT7648/MT7746	114.48b	59.40a	177.67	35.96	.00	.00
MT 8612	CI15838/MT7418//PONDERA	113.67b	61.17a	174.33b	35.17	.00	.00
MT 8289	TANAGER "S"	111.95b	57.43	174.00b	35.17	.00	.00
MT 8833	PONDERA/ANGUS	111.93b	59.77a	173.33b	37.66	.00	.00
MT 8849	RS6880/MT7819	111.67b	60.13a	177.67	37.27	.00	.00
MT 8615	CI15838/MT7418//PONDERA	111.45b	61.03a	176.00	37.14	.00	.00
MT 8812	MARBERG/MT7746	111.22b	59.23a	171.33b	35.30	.00	.00
MT 8402	MT7336/SHORTANA	110.88b	60.57a	172.67b	34.51	.00	.00
MT 8824	MARBERG/MT7746	110.05b	60.33a	172.67b	38.45	.00	.00
MT 8827	PONDERA/MT7732	109.97b	60.17a	176.33	37.53	.00	.00
MT 8858	MT7421/BUTTE	109.58b	57.77	177.33	37.66	.00	.00
MT 8822	MT7635/ANTIZANA	109.30b	60.03a	177.33	42.65a	.00	.00
MT 8651	CI15838/MT7418//PONDERA	108.88b	59.67a	177.00	36.22	10.00	1.67a
MT 8626	CI15838/MT7418//PONDERA	108.78b	60.10a	173.33b	35.17	.00	.00
MT 8828	PONDERA/ANGUS	108.58b	59.17a	173.33b	34.25	.00	.00
NKF 8022	KLASIC	108.57b	55.50b	169.00b	26.90b	.00	.00
MT 8804	OLAF/MIVHOR1177	108.52b	58.97a	172.67b	33.60	.00	.00
C982-324	RAMBO	108.43b	60.30a	175.33b	33.99	.00	.00
CI 17430	NEWANA	108.40b	59.77a	178.67	32.28	.00	.00
MT8182SE	MT8182 SELECTION	107.67b	56.23	174.33b	32.55	.00	.00
C0982309	C0982309	106.68b	58.70a	177.33	37.80	.00	.00
PI510696	RENVILLE	106.53b	60.10a	178.67	44.88a	.00	.00
ND 606	AMIDON	106.02b	59.63a	176.67	41.47	.00	.00
CI 17828	PONDERA	105.37b	60.27a	173.67b	36.48	.00	.00
MT 8641	NEWANA/MT7746	105.22b	60.30a	174.33b	34.78	.00	.00
MT 8823	MT7747/LEW	103.77b	60.80a	178.33	41.21	.00	.00
MT 8653	MT7746/LEW	102.97b	60.77a	172.33b	42.52a	.00	.00
MT 8645	CI15838/MT7418//PONDERA	102.90b	59.87a	174.00b	33.99	.00	.00
MT 8801	OLAF/ISEPTON	102.58b	57.27	178.00	39.24	.00	.00
MT 8657	LEN/MT7632	101.78b	58.83a	171.33b	33.07	.00	.00
WB REGAL	WESTBRED REGAL	100.02b	59.07a	178.00	44.49a	.00	.00
PI483235	GLENMAN	99.67b	59.67a	177.67	36.22	6.67	1.00
CI 13596	FORTUNA	99.45b	60.40a	177.00	44.09a	10.00	1.00

Cont'd on next page

Table 2. (Cont'd)

VARIETY	Yield Bu/A	Test Wt Lbs/bu	Heading Date	Height Inches	Lodging /1 Prev	Lodging /2 Sever
CI 10003 THATCHER	96.43b	58.87a	176.33	48.56a	46.67a	1.67a
CI 17429 LEW	95.80b	60.97a	179.00	30.71	90.00a	3.67a
PI 15892 WARD	95.33b	59.10a	175.67b	43.70a	.00	.00
MT 8826 PONDERA/MT7732	95.23b	58.93a	175.67b	42.78a	.00	.00
MT 8808 LEW/MT7746	91.43b	57.27	172.00b	31.63	.00	.00
NDCUT CUTLESS	86.77b	58.93a	174.00b	39.89	71.67a	2.67a
CI 17282 CROSBY	84.97b	59.73a	176.33	44.49a	.00	.00
KAMUT KAMUT	71.10b	59.27a	180.00a	51.57a	99.00a	4.00a
EXPERIMENTAL MEANS	106.80	59.34	175.67	37.50	6.82	.32
F TEST FOR VAR.	5.62**	14.52**	16.49**	5.44**	21.13**	6.42**
C.V. 2: (S OF MEAN/MEAN)*100	4.26	.59	.35	5.42	70.14	111.39
LSD (0.05)	12.76	.98	1.73	5.71	13.42	1.00

1/ Lodging prevalence is the percent of plot lodged
2/ Lodging severity is the degree of lodging, 9 = grain lodged to ground, 0 = grain upright
3/ Check variety (Owens)
** Indicates statistical significance at the .01 level.
a/ Values significantly greater than the check at the .01 level
b/ Values significantly less tahn the check at the .01 level

Table 3. Agronomic data from the offstation spring wheat nursery grown on the Western Agricultural Research Center in Corvallis, MT.

Date planted: April 17, 1989 Harvested: August 17, 1989

CI or State #	VARIETY	YIELD BU/A	TEST WT LB/BU	HEIGHT IN
CI 17904	OWENS 1/	75.49	58.43	29.13
CI 17920	MARSHALL	72.04	58.10	26.51
CI 17430	NEWANA	54.35	60.30a	26.90b
WA 6920	PENAWAWA	52.50	58.63	23.88
CI 17790	LEN	52.23	57.93	27.43
ND 606	AMIDON	50.88	57.90	32.55
CI 17429	LEW	48.60	60.37a	32.81
PI483235	GLENMAN	48.41	57.50	27.03
MT 8402	MT7336/SHORTANA	46.83	59.07	24.41b
CI 17910	ALEX	46.18	58.60	32.02
MT 8182	YDING "S"/PCI "S"-28	43.24	55.63b	27.17
CI 17828	PONDERA	40.54	57.10b	27.43
NDCUT	CUTLESS	37.40	57.77	27.56
ND 582	STOA	37.00	58.90	30.84
C982-324	RAMBO	33.23	59.20	26.51
NK 751	NK 751	32.71	58.03	23.49b
CI 15930	OLAF	28.08	58.17	27.17
CANLANC	LANCER	27.51	57.70	29.92
WPB 906R	WESTBRED 906R	25.80	58.57	24.54b
CI 13596	FORTUNA	25.11	56.80b	28.35
	EXPERIMENTAL MEANS	43.91	58.24	27.78
	F TEST FOR REPS.	1.63	3.61	8.53
	F TEST FOR VAR. 2/	1.17	10.65**	2.95**
	C.V. 2: (S OF MEAN/MEAN)*100	29.31	.58	5.76
	LSD (0.05)	36.84	.96	4.58

1/ Check variety (Owens)
2/ F value for variety comparison
** Indicates statistical significance at the .01 probability level
a/ Values significantly greater than the check at the .01 level
b/ Values significantly less than the check at the .01 level

Table 4. Agronomic data from the 1989 Triticale Nursery grown on the Northwestern Agriculture Research Center, Kalispell, MT. A3

Planted: April 7, 1989 Harvested: August 30, 1989

	VARIETY	Yield Bu/A	Test Wt Lbs/Bu	Heading Date	Height Inches
TRITJUAN	JUAN	75.78	52.53	171.67	45.01
TRITOT54	7431A-154B/7634-292B	75.15	53.03	170.00	43.96
TRITWELS	WELSH	75.10	50.93	169.33	47.11
TRITOT61	IRA/BGL//DRIRA/KANG(	74.78	54.63	169.00	40.42
TRITOT44	WAPITI	71.37	52.33	171.00	45.93
CI 17430	NEWANA	70.08	57.93	171.67	32.94
TRITKRAM	KRAMER	69.97	47.77	170.00	40.03
TRITMARV	MARVAL	69.58	49.17	169.67	48.16
TRITBEAG	BEAGLE 82	68.75	50.70	172.33	45.93
TRITCARM	CARMAN	68.50	50.37	169.67	44.88
TRITOSUN	SUNLAND	65.20	54.20	172.33	41.73
TRITKARL	KARL	64.80	49.00	170.00	33.73
	EXPERIMENTAL MEANS	70.76	51.88	170.56	42.49
	F TEST FOR REPS.	7.80	11.72	3.00	4.44
	F TEST FOR VAR.	.50	107.36	2.89	44.70
	C.V. 2: (S OF MEAN/MEAN)*100	7.56	.53	.41	1.75
	LSD (0.05)	15.70	.80	2.04	2.17

PROJECT TITLE: Winter Wheat Variety Evaluations

YEAR/PROJECT: 1989/756

PROJECT PERSONNEL: Leader - Vern R. Stewart, Todd K. Keener - Research Specialist, NWARC, Kalispell, MT

SUMMARY:

Severe winter temperatures destroyed the Intrastate and Western Regional Soft White winter wheat nurseries this season. Because of the winter injury, stands in the hard red winter wheat nursery were greatly reduced. The average yield for that test was 48 bushel/acre. The two offstation nurseries in Lake and Ravalli County had fair yields.

RESULTS:

The hard red winter Intrastate wheat nursery and the Western Regional Soft White Wheat nursery were severely injured by extreme temperatures that occured early February when wind chill factors exceeded 90 degrees below zero. Because of the severe damage to these two tests, the experiments were abandoned.

1989 Western Regional Hard Red Winter Wheat Nursery

Winter kill was 100% in three of the entries in this nursery. The variety UT 15751 and a survival rate of 87.5%, which was the highest for the nursery. Generally, the varieties had about 50% survival; however the test mean was 38.68%. Because of this stand reduction, there was a great reduction in yield as contrasted to previous years. The highest yielding entry was Idaho 381 at 82.5 bushels/acre. The average yield for the nursery was 48.63 bu/A. Test weights were reduced and the harvest date averaged about five days later than normal. Table 1.

1989 Lake County Offstation Winter Wheat Nursery.

Yields were very good for this nursery considering it was located on a recrop site. Stand losses due to winter kill were not consistent for varieties between replications. Location with in the nursery seemed to have as much effect on injury as did the variety. Yields range from 42.9 to 94.5 bu/A. Test weights were good with the mean being about 59.44 lbs/bu. Table 2.

1989 Ravalli County Offstation Winter Wheat Nursery

The yields from the Ross McIntyre farm in Ravalli Co. were some of the best that we recorded in that area. Rocky was the highest yielding entry with 60.9 bu/A. The lowest yielding entry was MT 88065. Test weights were fair with the average being 58.15 lbs/bu. Table 3.

FUTURE PLANS:

Winter wheat variety evaluations will continue with emphasis on selecting genetic material for dwarf smut resistance.

Table 1. Agronomic data from the 1989 Western Regional Hard Red Winter Wheat Nursery grown on the Northwestern Agricultural Research Center, Kalispell, MT.

Date planted: Sept. 16, 1988 Date harvested: Sept. 11, 1989

VARIETY	Yield Bu/A	Test Wt Lbs/Bu	Height Inches	Heading Date	% /1 Surviv	- Lodging- %	angle
ID 0381 ABERDEEN SEL	82.58	55.40	36.22	168.00	45.00	12.50	1.00
QT 542 WINTER WHEAT HYBRID	79.06	58.40	36.42	159.25	67.50	.00	.00
UT160719 MNG/SMS	77.54	55.15	34.25	163.25	75.00	.00	.00
ID 0352 ABERDEEN SEL	76.60	56.80	35.83	165.00	72.50	.00	.00
UT156751 MNG/BEZ1	70.91	57.50	32.28	163.00	87.50	.00	.00
UT157140 HNL/USSR 2109-36	68.58	56.60	34.65	165.50	32.50	.00	.00
WA 7523 LIND SELFRG/SRG (FIE	67.86	51.50	33.46	167.75	38.75	2.50	1.25
MT 8039 LCD/FRD//NE 69559/WN	66.24	50.05	31.69	162.25	60.00	.00	.00
ID 0361 CNN//7*LEE/TF/5/SM4/	65.81	56.20	30.51	167.25	45.00	.00	.00
ID 0326 ABERDEEN SEL	63.25	55.25	26.97	163.25	55.00	.00	.00
UT160477 MNG/6/MT C61-9/BGR/5	62.89	53.50	29.13	163.25	82.50	.00	.00
QT 562 WINTER WHEAT HYBRID	62.15	55.15	29.53	160.75	48.75	.00	.00
MT 7811 FRD/WNK//MT 6928/TR	60.90	53.75	36.22	164.75	72.50	.00	.00
WA007647 286011/ANDREWS	58.85	53.90	36.22	167.75	52.50	.00	.00
ID 0353 ABERDEEN SEL	58.63	56.25	31.30	165.25	67.50	.00	.00
ID 0364 ABERDEEN SEL	58.19	56.10	33.86	164.50	67.50	.00	.00
WA007648 PI173467/GNS/3/BNK//	57.78	50.30	28.35	166.75	32.50	.00	.00
CI 13844 WANSER	57.56	55.45	37.99	165.25	60.00	8.75	1.50
CI 1442 KHARKOF	56.85	54.55	42.32	164.25	72.50	91.25	5.25
MT 79125 UT755079/CST56//TX65	56.40	52.30	32.48	164.25	42.50	.00	.00
ID 0332 II60156/CI 14107//IT	55.49	51.60	35.63	164.75	37.75	18.75	4.25
WA 7620 N7701501//V72044/CER	53.69	50.70	35.63	167.75	37.75	.00	.00
WA007649 HTN S/3/BEZ/CI 13438	52.56	51.90	31.30	171.75	17.75	.00	.00
WA 7619 N7701501//V72044/CER	51.89	50.05	37.20	169.00	47.75	.00	.00
WA 7626 HARD WHITE 1987 ML	49.25	52.85	28.35	167.00	23.75	.00	.00
WA007646 CER/HTN	48.31	52.50	32.48	166.00	28.75	.00	.00
WA007650 N7000063/K71056//UT9	48.26	47.50	37.80	167.50	37.75	20.00	1.50
ORCR8608 CORVALLIS SEL	33.35	53.75	26.38	168.00	7.75	.00	.00
UT162334 BEZ1/MNG/3/HNL//IT/P	29.84	55.10	33.86	166.00	9.00	.00	.00
OR 8522 VORO/MNIM,85B-839	28.16	55.35	33.46	167.50	5.25	.00	.00
ID 0362 HGL/RGR//A65249W-12-	26.05	55.75	28.15	166.50	12.75	.00	.00
OR831134 CORVALLIS SEL	25.42	53.05	28.35	166.75	17.50	.00	.00
ORCR8601 PMF//CNO S/GLL	24.95	52.50	31.30	164.25	5.75	.00	.00
ORCR8602 CORVALLIS SEL	21.30	54.25	24.61	165.75	12.75	.00	.00
ORCR8603 CORVALLIS SEL	18.68	50.30	24.61	164.75	12.75	.00	.00
OR830282 CORVALLIS SEL	17.47	53.60	22.44	165.25	16.25	.00	.00
OR832306 CORVALLIS SEL	2.16	.00	24.41	165.50	.00	.00	.00
OR830027 CORVALLIS SEL	1.00	.00	33.86	41.25	.00	3.75	1.00
ORCR8718 CORVALLIS SEL	.00	.00	28.74	82.50	.00	.00	.00

* Statistics and footnotes on next page

VARIETY	Yield Bu/A	Test Wt Lbs/Bu	Height Inches	Heading Date	% Surviv	-- Lodging- %	angle
EXPERIMENTAL MEANS	48.63	49.61	32.01	160.23	38.68	4.04	.40
F TEST FOR VAR. 2/	14.14	14.92	7.47	5.49	10.46	12.19	4.91
C.V. 2: (S OF MEAN/MEAN)*100	12.24	.79	5.06	6.33	20.72	107.29	124.71
LSD (0.05)	16.67	1.12	4.63	28.40	22.45	12.14	1.41

1/ % Surviv = percentage of plot surviving winter kill
2/ F value for variety comparison, all F values were highly significant

Table 2. Agronomic data from the 1989 Offstation Winter Wheat Nursery grown on the Ed Wehrheim farm, Lake County, Moiese, MT.

Planted: September 13, 1988 Harvested: August 4, 1989

CI or State #	VARIETY	YIELD BU/A	TEST WT LB/BU	HEIGHT INCHES	% SURVL	--- LODGING --- ANGLE	%
CI 17846	MANNING	94.47	58.87	39.63	81.67	3.33	63.00
CI 17419	DAWS	86.62	59.53	32.28	88.33	.00	.00
MT 88065	CST/VT1230//ID745101	77.19	59.23	40.55	50.00	.67	8.33
CI 17879	ROCKY	74.49	59.50	43.04	83.33	1.67	33.00
CI 17909	LEWJAIN	73.87	58.57	39.63	61.67	.00	.00
MT 8003	TIBER	73.55	60.40	40.42	81.67	.00	.00
ID 297	BLIZZARD	70.65	60.50	43.18	71.67	2.33	33.00
CI 17735	NORSTAR	69.49	60.47	48.82	68.33	3.00	96.00
CI 17860	NEELEY	68.99	59.10	36.61	45.00	2.00	64.67
CI 17902	WINRIDGE	67.33	58.93	37.53	80.00	3.67	44.67
CI 13670	WINALTA	66.93	59.00	46.33	55.00	4.33	83.33
PI491533	NORWIN	65.87	60.93	27.95	63.33	.00	.00
MT 88062	CST/VT1230//ID745101	65.67	59.20	41.60	81.67	1.67	35.00
CI 17441	VONA	63.82	60.73	35.17	43.33	.00	.00
CI 17727	WESTON	61.88	62.20	41.86	65.00	1.33	56.67
MT 8039	JUDITH	59.93	59.23	37.53	55.00	.00	.00
PI491532	CREE	58.65	60.20	43.18	66.67	3.67	82.67
CI 17594	STEPHENS	57.43	56.87	37.14	40.00	.00	.00
CI 8885	CHEYENNE	57.12	60.27	43.18	71.67	3.33	56.67
MT 88064	CST/VT1230//ID745101	51.77	56.40	40.55	38.33	1.67	55.00
MT 79125	UT755079/CST56//TX65	51.41	57.27	34.38	55.00	.00	.00
CI 17844	REDWIN	51.05	59.90	42.13	40.00	.00	.00
CI 13190	WARRIOR	49.70	59.47	43.44	60.00	2.67	58.00
CI 15075	CENTURK	42.86	59.80	40.94	61.67	1.67	46.67
	EXPERIMENTAL MEANS	65.03	59.44	39.88	62.85	1.54	34.03
	F TEST FOR VAR.	1.59	4.01**	3.37**	1.32	2.53**	2.77**
	C.V. 2:	14.55	1.09	6.19	21.11	60.00	56.83
	LSD (0.05)	26.93	1.84	7.03	37.76	2.63	55.05

** Indicates statistical significance at the .01 level of probability.

Special notes: When evaluating this agronomic data keep in mind that the nursery was recrop winter wheat, it was irrigated, and that winter kill was extensive in some varieties.

Table 3. Agronomic data from the 1989 Offstation Winter Wheat Nursery grown on the Ross McIntyre farm, Ravalli County, Stephensville, MT.

Planted: September 14, 1988 Harvested: August 1, 1989

VARIETY	YIELD BU/A	TEST WT LB/BU	HEIGHT INCHES
CI 17879 ROCKY	60.88	60.27	29.53
ID 297 BLIZZARD	59.28	61.47	30.18
CI 17846 MANNING	58.30	57.60	32.15
MT 8003 TIBER	52.55	59.73	32.28
CI 17735 NORSTAR	50.70	60.07	35.96
CI 17441 VONA	49.72	58.20	23.75
CI 17909 LEWJAIN	49.30	56.57	24.02
CI 17419 DAWS	48.72	56.77	25.33
MT 79125 UT755079/CST56//TX65	47.93	57.90	26.90
CI 17727 WESTON	47.25	59.90	31.50
CI 15075 CENTURK	47.17	59.33	24.93
CI 13190 WARRIOR	47.00	58.63	28.61
PI491532 CREE	46.93	60.10	30.58
CI 13670 WINALTA	46.55	59.90	33.20
CI 17902 WINRIDGE	45.98	56.63	29.66
PI491533 NORWIN	45.58	59.33	20.60
MT 88062 CST/VT1230//ID745101	44.05	55.77	28.08
CI 17844 REDWIN	43.90	60.07	30.84
MT 8039 JUDITH	43.33	55.90	32.55
CI 17860 NEELEY	42.88	56.37	26.77
MT 88064 CST/VT1230//ID745101	42.43	54.10	30.58
CI 17594 STEPHENS	41.30	54.27	25.59
CI 8885 CHEYENNE	40.67	59.33	29.13
MT 88065 CST/VT1230//ID745101	39.15	57.30	25.20
EXPERIMENTAL MEANS	47.57	58.15	28.66
F TEST FOR VAR.	.73	9.97**	3.70**
C.V. 2: (S OF MEAN/MEAN)*100	13.93	1.09	6.58
LSD (0.05)	18.86	1.81	5.37

** Indicates statistical significance at the .01 level pf probability.

YEAR/PROJECT: 1988-89/758: ANNUAL FORAGE LEGUME MANAGEMENT FOR SUSTAINING NITROGEN

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Mal Westcott, Corvallis

'Nitro' annual alfalfa and 'Bigbee' berseem clover were managed for hay only, hay and green manure, and green manure only. The two species were planted on May 3, 1988 and fertilized with 50 lbs/a P2O5. Each species was harvested for hay from 0-3 times during the growing season with all regrowth for each treatment being plowed for green manure. The best cutting schedule, regardless of species, was two hay cuts and green manuring the third cutting. This allowed for 2.05 t/a hay and 0.89 t/a green manure for Nitro and 2.72 t/a hay and 0.64 t/a green manure for Bigbee. When managed for three harvests and then green manuring regrowth, Nitro produced 640 lbs/a more forage than Bigbee. The nursery was cropped to barley in 1989 to measure N contribution of 1988 treatments through crop response. When two hay harvests were taken in 1988 and the regrowth was green manured, barley yields in 1989 were maximized for each species without additional fertilizer nitrogen.

Table 1. Annual Legume Forage and Green Manure Yields in 1988

SPECIES	CUTTING SCHEDULE	Harvest 1st	Harvest 2nd	Harvest 3rd	TOTAL HAY	GREEN MANURE
		t/a				
Nitro	GM				0	1.83
	7/11,GM	0.83			0.83	1.53
	7/11,8/26,GM	0.85	1.20		2.05	0.89
	7/11,8/26,10/11	0.83	1.19	1.02	3.04	0
	7/11,8/11,9/11,GM	0.91	0.97	0.97	2.85	0.16
Bigbee	GM				0	2.62
	7/11,GM	0.92			0.92	2.32
	7/11,8/26,GM	1.09	1.63		2.72	0.64
	7/11,8/26,10/11	0.90	1.56	0.58	3.05	0
	7/11,8/11,9/11,GM	0.97	0.83	0.73	2.52	0.14
	LSD(0.05) between harvest schedules =				0.18**	0.17**

HARVEST DATES	SPECIES Nitro	Bigbee	Means
	Yield (t/a)		
10/11-GM	1.83	2.62	2.22
7/11,10/11-GM	2.36	3.24	2.80
7/11,8/26,10/11-GM	2.95	3.36	3.15
7/11,8/26,10/11-HAY	3.04	3.05	3.04
7/11,8/11,9/11,10/11-GM	3.01	2.66	2.83
Means	2.64	2.98	

LSD(0.05) between harvest means = 0.22 t/a (P=0.00)
LSD(0.05) of interaction means = 0.55 t/a (P=0.00)
Difference between species means is not significant (P=0.12)

Seeding date: 5/3/88
Fertilizer: Spring, 1988 - P2O5 - 50 lbs/a (all plots) +
N - 60 lbs/a on barley plots
Pesticides: Preplant - Eptam - 3 lbs AI/a
Crop year precipitation: 13.94"
Irrigation: 2" on 6/23, 1.5" on 7/25, 2" on 8/19, 2" on 8/30
Last spring frost: May 3 (30 degrees F)
First fall frost: Sept.12 (30 degrees F)

Table 2. Barley grain yield in 1989 as affected by previous year's annual legume management.

HARVEST TREATMENT	1988 CROP 'NITRO' ALFALFA	'BIGBEE' BERSEEM	MEAN
	1989 Barley Yield (bu/a)		
GM-10/15	101.0	111.1	102.2
7/11,GM-10/15	105.9	108.2	108.1
7/11,8/26,GM-10/15	103.2	107.5	108.0
7/11,8/26,hay-10/15	99.4	97.3	100.8
7/11,8/11,9/11,GM-10/15	111.6	103.2	108.7
MEAN	104.2	105.4	

LSD(0.05) between species means = 6.8 bu/a (not significant).
LSD(0.05) between treatment means = 5.6
LSD(0.05) between interaction means = 11.4.

Seeding date: 4/20/89
Fertilizer: 4/19/89 - P2O5 - 50 lbs/a
5/12/89 - N - 30,60,90,120 lbs/a applied to 1988 barley check plots
Pesticides: 5/15/89 - Stinger -1/3 pint/a
Crop year precipitation: 23.39"
Irrigation: 2" on 8/7/89
Last spring frost: May 21 (32 degrees F)
First fall frost: Sept.9 (29 degrees F)

Table 3. Barley grain yields and quality factors in 1989 as affected by previous year's annual legume management and fertilizer N rate.

SPECIES	TREATMENT	TEST WT lbs/bu	PLUMP %	GRAIN YLD bu/a
Barley	N-60	47.4	93	113.3
Nitro	7/11,8/11,9/11,10/15	49.5	98	111.6
Barley	N-120	47.1	95	111.4
BigBee	GM-10/15	49.4	97	111.1
Barley	N-30	47.0	96	110.3
BigBee	7/11,GM-10/15	49.3	98	108.2
BigBee	7/11,8/26,GM-10/15	49.2	97	107.5
Nitro	7/11,GM-10/15	49.8	95	105.9
Barley	N-90	47.0	95	105.9
Nitro	7/11,8/26,GM-10/15	49.3	98	103.2
BigBee	7/11,8/11,9/11,10/15	49.1	98	103.2
Nitro	GM-10/15	49.4	98	101.0
Nitro	7/11,8/26,HAY-10/15	49.4	98	99.4
BigBee	7/11,8/26,HAY-10/15	49.3	97	97.3
Barley	N-0	47.9	92	94.5
LSD(0.05)		1.0	3	10.1

Seeding date: 4/20/89
Fertilizer: 4/19/89 - P2O5 - 50 lbs/a
5/12/89 - N - 30,60,90,120 lbs/a applied to 1988 barley check plots
Pesticides: 5/15/89 - Stinger -1/3 pint/a
Crop year precipitation: 23.39"
Irrigation: 2" on 8/7/89
Last spring frost: May 21 (32 degrees F)
First fall frost: Sept.9 (29 degrees F)

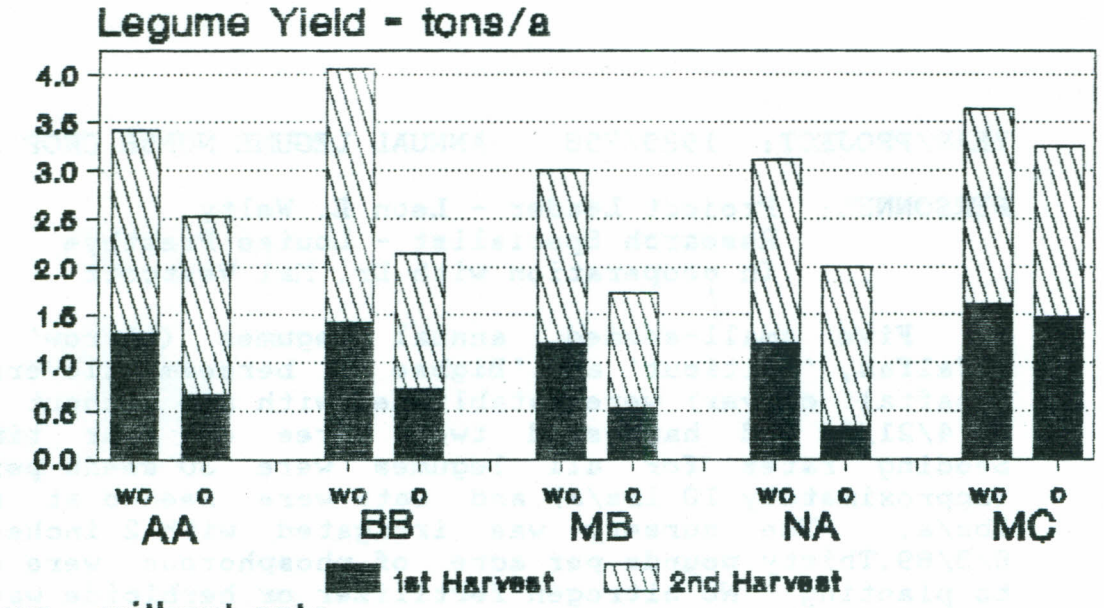
YEAR/PROJECT: 1989/758 ANNUAL LEGUME NURSE CROP STUDY

PERSONNEL: Project Leader - Leon E. Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Mal Westcott

Five small-seeded annual legumes ('Arrow' and 'Nitro' alfalfas, 'Multicut' and 'Bigbee ' berseem clovers and 'Maral Schaftal' clover) were established with and without 'Monida' oats on 4/21/89 and harvested two, three or four times in 1989. Seeding rates for all legumes were 30 seeds per linear foot (approximately 10 lbs/a) and oats were seeded at a rate of 40 lbs/a. The nursery was irrigated with 2 inches of water on 8/3/89.Thirty pounds per acre of phosphorous were applied prior to planting. No nitrogen fertilizer or herbicide was used.

Forage yields were higher whenever oats were included in the mixture, but quality of the total forage was undoubtedly lower (samples sent to Bozeman for quality analyses). Generally, harvesting at more frequent intervals (four times vs. two times) resulted in less total legume yield. Except for Arrow alfalfa under the four cut system, all legumes yielded over two tons per acre for the season when planted without the oat nurse crop. Maral Schaftal clover yielded over three tons per acre when cut twice regardless of whether or not oats were seeded as a nurse crop.

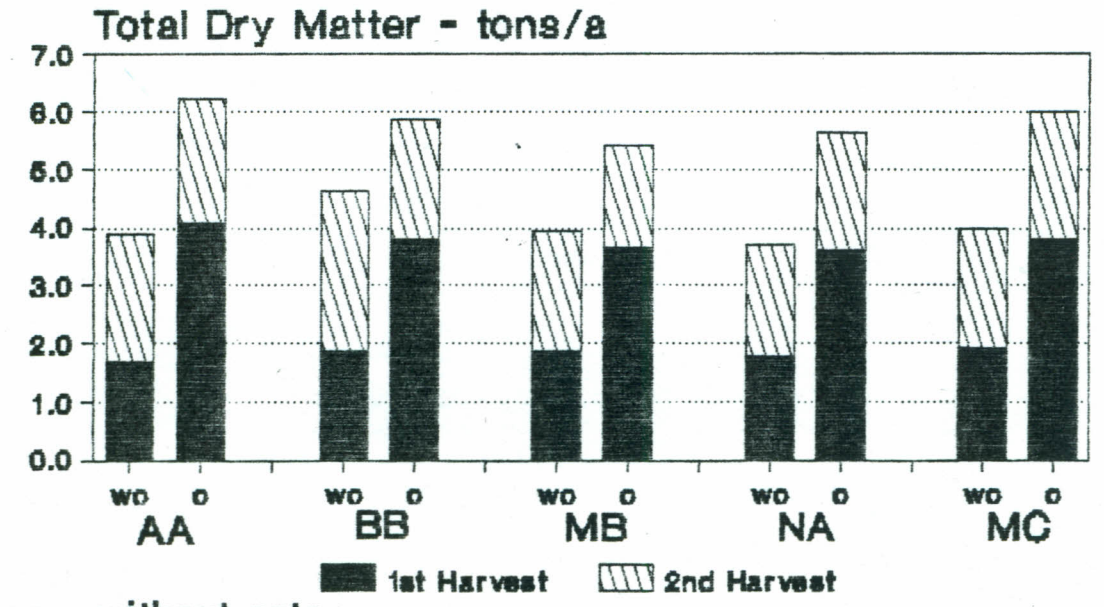
ANNUAL LEGUME COMPANION CROP STUDY
KALISPELL - 1989
TWO HARVEST MANAGEMENT



wo = without oats
o = with oats

LSD(0.05):oats x sp = 0.75 t/a P=0.02

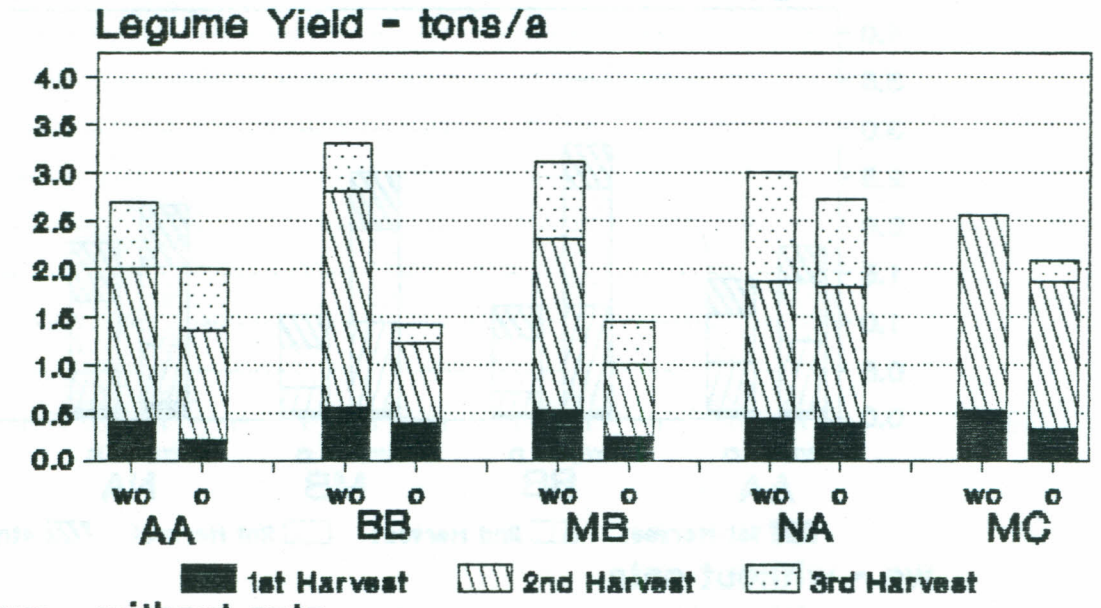
ANNUAL LEGUME COMPANION CROP STUDY
KALISPELL - 1989
TWO HARVEST MANAGEMENT



wo = without oats
o = with oats

LSD(0.05):oats x sp = 1.00 t/a P=0.20

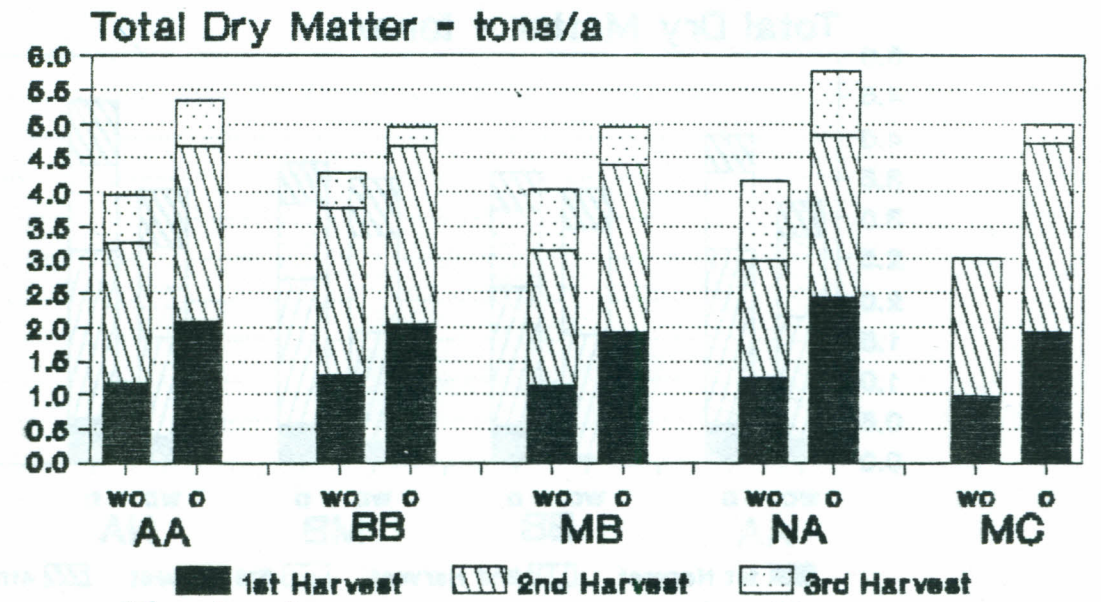
ANNUAL LEGUME COMPANION CROP STUDY
KALISPELL - 1989
THREE HARVEST MANAGEMENT



wo = without oats
o = with oats

LSD(0.05) oats x sp = 1.04 t/a P=0.01

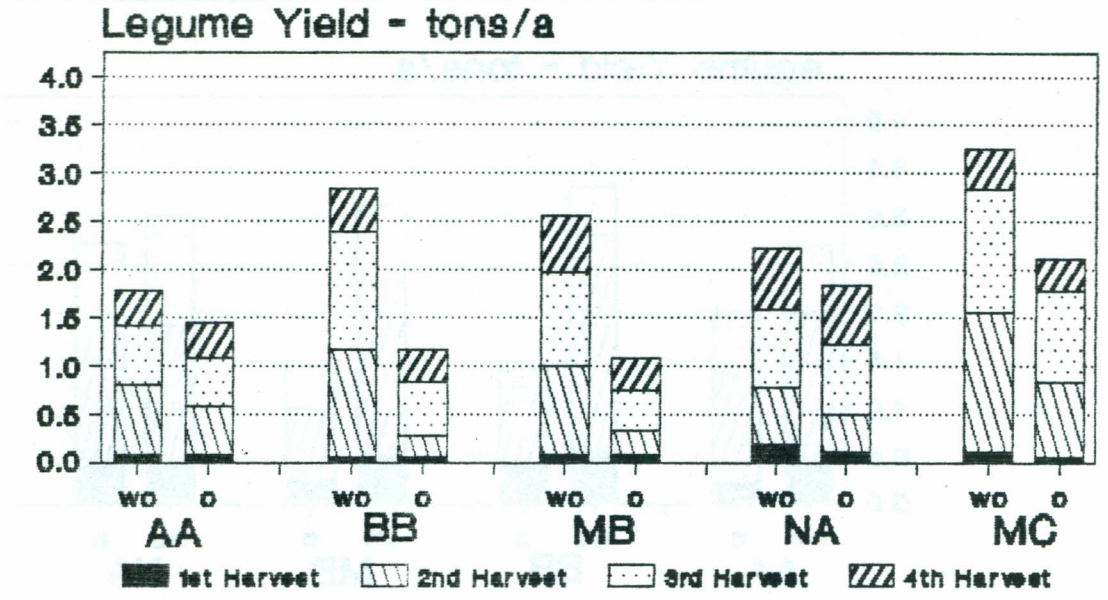
ANNUAL LEGUME COMPANION CROP STUDY
KALISPELL - 1989
THREE HARVEST MANAGEMENT



wo = without oats
o = with oats

LSD(0.05) oats x sp = 1.04 t/a P=0.01

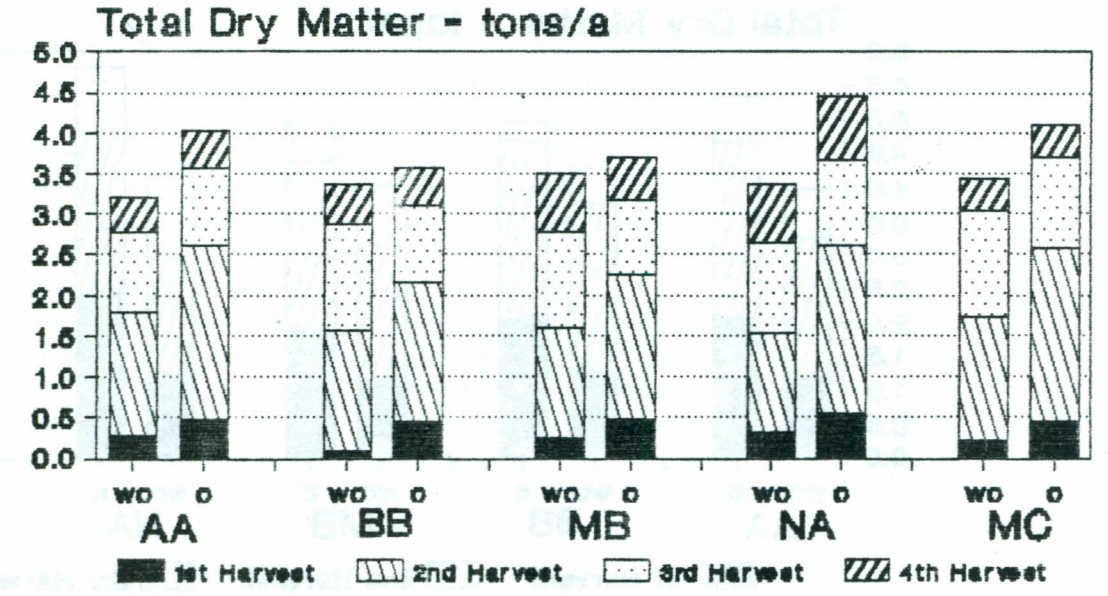
ANNUAL LEGUME COMPANION CROP STUDY
KALISPELL - 1989
FOUR HARVEST MANAGEMENT



wo = without oats
o = with oats

LSD(0.05) oats x sp = 0.78 t/a P<0.01

ANNUAL LEGUME COMPANION CROP STUDY
KALISPELL - 1989
FOUR HARVEST MANAGEMENT



wo = without oats
o = with oats

LSD(0.05) oats x sp = 0.93 t/a (P=0.40)

YEAR/PROJECT: 1989/758

BERSEEM CLOVER - NITRO ALFALFA SEEDING DATE STUDY

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Ray Ditterline, Bozeman

The purpose of this study was to determine the optimal time to seed berseem clover and annual alfalfa. The study was duplicated at Bozeman, Huntley, Corvallis and Moccasin. Varieties used were 'Bigbee' and 'Multicut' berseem clovers and 'Nitro' alfalfa.

The study was designed as a split-plot randomized complete block with four replications. Main plots were five planting dates spaced ten days apart, and subplots were varieties. Subplots were seeded as four 15 foot rows one foot apart with 3 feet between plots. The rows were later trimmed back to 12 feet. Actual plot sizes were measured after establishment, and average harvest area was determined to be 69 square feet.

The nursery was fertilized with 44 lbs of P2O5/a. Seeding rate was 8.5 lbs/a. Planting dates were 4/11, 4/20,5/1, 5/11, and 5/22/89. On 5/4/89 Poast was applied at 1.5 pt/a. Main plots were harvested three times on the following dates: PD-1 on 7/7, 8/7 and 9/6; PD-2 on 7/10, 8/7 and 9/6; PD-3 on 7/19, 8/18 and 9/27; PD-4 on 7/21, 8/18 and 9/27; PD-5 on 7/24, 8/22 and 9/27. Yields were obtained using an ALMACO forage harvester and weighing and drying a sub-sample from each plot to determine dry matter yield. These sub-samples were also ground in a Wiley mill and sent to Bozeman for quality analysis.

Yield data was analyzed by harvest as a 5 x 3 factor split plot using MSUSTAT program AVMF. In all but one case, significant differences among main effect means and interaction means were found at the 0.05 probability level. In general, it appears that yields for all three varieties were highest when planted early, decreasing with each 10 day delay. Also, Bigbee berseem produced less forage than Multicut berseem and Nitro alfalfa, whose total species means differed by only one percent.

ANNUAL LEGUME PLANTING DATE STUDY - KALISPELL, 1989

FIRST HARVEST

PLANTING DATE	SPECIES: Bigbee Berseem Clover	Multicut Berseem Clover	Nitro Alfalfa	Planting Date Means
	Yield - lbs/a			
April 11	1580	1279	1175	1345
April 20	1281	1290	1228	1266
May 1	1528	1590	1495	1537
May 11	1288	1290	1290	1289
May 22	1017	1127	1153	1099
Species Means	1339	1315	1268	

LSD(0.05) between planting date means = 117 lbs/a (P=0.00).
LSD(0.05) between species means = 75 lbs/a (P=0.16).
LSD(0.05) between interaction means = 189 lbs/a (P = 0.01).

SECOND HARVEST

PLANTING DATE	SPECIES: Bigbee Berseem Clover	Multicut Berseem Clover	Nitro Alfalfa	Planting Date Means
	Yield - lbs/a			
April 11	2447	2548	2309	2435
April 20	2284	2112	2054	2150
May 1	1798	2421	2207	2142
May 11	1695	2060	1687	1814
May 22	1470	1603	1443	1505
Species Means	1939	2149	1940	

LSD(0.05) between planting date means = 202 lbs/a (P=0.00).
LSD(0.05) between species means = 133 lbs/a (P=0.00).
LSD(0.05) between interaction means = 318 lbs/a (P = 0.03).

THIRD HARVEST

PLANTING DATE	SPECIES: Bigbee Berseem Clover	Multicut Berseem Clover	Nitro Alfalfa	Planting Date Means
	Yield - lbs/a			
April 11	763	1744	1957	1488
April 20	840	1636	1860	1445
May 1	348	1044	1277	889
May 11	538	959	1175	891
May 22	357	983	947	762
Species Means	569	1273	1443	

LSD(0.05) between planting date means = 140 lbs/a (P=0.00).
LSD(0.05) between species means = 116 lbs/a (P=0.00).
LSD(0.05) between interaction means = 257 lbs/a (P = 0.03).

TOTAL HARVEST - 1989

PLANTING DATE	SPECIES: Bigbee Berseem Clover	Multicut Berseem Clover	Nitro Alfalfa	Planting Date Means
	Yield - lbs/a			
April 11	4790	5571	5668	5343
April 20	4405	5038	5361	4935
May 1	3673	5054	4979	4568
May 11	3520	4309	4152	3993
May 22	2843	4008	3544	3465
Species Means	3846	4796	4741	

LSD(0.05) between planting date means = 251 lbs/a (P=0.00).
LSD(0.05) between species means = 173 lbs/a (P=0.00).
LSD(0.05) between interaction means = 407 lbs/a (P = 0.04).

Fertilizer: 44 lbs/a P2O5
Herbicide: 1.5 pt/a Poast on 5/4
Crop year precipitation (9/1/88 - 8/31/89): 23.39" (avg = 19.51")
Irrigation: 2" on 7/12; 2" on 8/3
Last frost in spring: 32 degrees F on 5/21 (avg = 5/25)
First frost in fall: 29 degrees F on 9/9 (avg = 9/13)
Frost free period: 110 days (avg = 112)
Maximum summer temperature: 96 degrees F on 8/1.

YEAR/PROJECT: 1989/758 STATEWIDE LEGUME ADAPTATION TRIAL - IRRIGATED

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Jim Sims, Bozeman

On 4/19/89 nine large-seeded and eleven small-seeded annual legumes were established. Seeding rates were as follows: 116 lbs/a 'Red' kidney bean; 107 lbs/a 'NC8-3' chickling vetch; 89 lbs/a 'Semu-SI Feed Pea; 71 lbs/a 'Austrian' winter pea and 'Tinga' tangier flatpea; 62 lbs/a 'Red Chief' lentil; 49 lbs/a 'UI 114' pinto bean; 71 lbs/a 'Maple Amber' soybean; 27 lbs/a 'Indianhead' lentil and 'Robinson' snail medic; 22 lbs/a 'Paraponto' gamma medic and 'Maral Schaftal' clover; 18 lbs/a 'Mt.Barker' subterranean clover; 13 lbs/a 'Jemalong' barrel medic; 9 lbs/a 'Bigbee' berseem clover, 'Multicut' berseem clover, 'Common Yellow' sweetclover, 'Youchi' arrowleaf clover, 'George Black' medic, and 'Nitro' alfalfa. Seed was mixed with species specific Rhizobium inoculum and planted in four 15 ft. rows 1 ft. apart, 4 rows per plot. Varieties were assigned in an RCB design with 4 replications. Each plot (60 sq.ft.) was harvested with an ALMACO forage harvester and plot yield recorded. A subsample from each plot was weighed wet and then dry to determine dry matter yields and to be analyzed for quality. Species were harvested on 7/10/89 and again on 8/7 and 9/25 if sufficient regrowth had occurred.

Multicut berseem clover, Maral Schaftal clover, Nitro alfalfa, and Bigbee berseem clover had the highest total yields for the season. Of the large-seeded legumes, Semu-SI feed pea had significantly higher yield than NC8-3 chickling vetch, which had significantly higher yield than the other species. Poorest yields came from Paraponto gamma medic, Maple Amber soybean and Red kidney bean. The beans had poor regrowth, and the medic with its low spreading growth habit was difficult to harvest. On 8/7/89 Maral Schaftal had significantly more regrowth than any other species, followed by Bigbee, Common Yellow, Multicut and Nitro. On 9/25 only 8 species had enough regrowth to cut: Multicut was highest, followed by Nitro, Bigbee and Maral Schaftal.

STATEWIDE LEGUME ADAPTATION TRIAL
KALISPELL, 1989

LEGUME	7/10/89	8/7/89	9/25/89	TOTAL
	YIELD (t/a)			
Multicut Berseem Clover	0.34	1.14	1.26	2.74
Maral Shaftal Clover	0.57	1.59	0.47	2.63
Nitro Alfalfa	0.43	1.07	1.08	2.58
Bigbee Berseem Clover	0.32	1.37	0.89	2.58
Semu-SI Feed Pea	2.20	0.22	0.00	2.42
NC8-3 Chickling Vetch	1.24	0.44	0.37	2.05
Austrian Winter Pea	1.34	0.36	0.00	1.70
Tinga Tangier Flatpea	0.86	0.46	0.29	1.61
Common Yellow Sweetclover	0.19	1.29	0.00	1.48
Jemalong Barrel Medic	0.21	0.70	0.42	1.33
Red Chief Lentil	1.23	0.00	0.00	1.23
Mt.Barker Sub.Clover	0.00	0.77	0.43	1.20
Indianhead Lentil	0.83	0.31	0.00	1.14
Robinson Snail Medic	0.96	0.00	0.00	0.96
George Black Medic	0.37	0.54	0.00	0.91
Youchi Arrowleaf Clover	0.00	0.70	0.00	0.70
UI 114 Pinto Bean	0.21	0.34	0.00	0.55
Red Kidney Bean	0.24	0.20	0.00	0.44
Maple Amber Soybean	0.18	0.07	0.00	0.25
Paraponto Gamma Medic	0.24	0.00	0.00	0.24
LSD(0.05)	0.17	0.19	0.13	0.31
P-VALUE	0.00	0.00	0.00	0.00
CV(s/mean)	19.8	23.7	34.0	15.3

Seeding date: 4/19/89
Crop year precipitation: 23.39"
Irrigation: 8/7/ - 2"
Fertilizer: 4/21 - P205 - 44 lbs/a
Herbicide: 5/4 - Poast - 1.5 pt/a
Last frost in spring: 5/21 - (32 degrees F)
First frost in fall: 9/9 (29 degrees F)

YEAR/PROJECT: 1989/758 DRYLAND LENTIL VARIETY YIELD TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr. Fred Muehlbauer, USDA

On 4/13/89 ten lentil varieties were seeded in a randomized complete block design with 4 replications. Plots consisted of four 12 foot rows spaced 1 foot apart with 2 feet between lots. After emergence, rows were trimmed back to 10 feet. At harvest time the actual lengths of the plots were measured and the mean plot size, 51 sq.ft., used as the harvest area.

There were no significant differences in emergence time among the varieties. Stand establishment was visually estimated and significant differences were found. 'Benewah' had the best stand (95%), and 'Crimson' had the poorest (84%). 'Laird' took longer to flower than any other variety, while 'Brewer', Benewah, 'Redchief' and 'Palouse' were the earliest. There was a 7 day range in time to maturity. 'Carmine' was earliest, with 102 days after seeding. Laird was slowest to mature - 109 days. Height varied from 13 inches (Carmine and Crimson) to 17 inches (Laird and 'Emerald'). All plants from each plot were pulled when they reached maturity (leaves, stems and seed pods mostly yellow to brown), and thrashed when dry. There was a great deal of overlap in yields, which ranged from 1984 lbs/a for Laird to 1609 lbs/a for Crimson. Carmine and Crimson had the smallest seeds (14,310/lb and 12,750 seeds/lb, respectively), and Laird, Benewah, and Palouse had the largest (5940, 6157 and 6221 seeds/lb, respectively).

LENTIL VARIETY TRIAL - KALISPELL, 1989

VARIETY	EMERG days 1/	STAND %	1st FLW days 2/	MATURITY days 3/	HEIGHT inches	SEED SIZE no/lb	YIELD lbs/a
Laird	13	93	77	109	17	5940	1984
Brewer	13	94	67	103	16	7209	1967
Emerald	13	89	72	108	17	7568	1951
Chilean 78	13	94	68	107	16	7799	1900
Benewah	13	95	67	106	16	6157	1863
Red Eston	13	89	68	103	15	9719	1801
Redchief	13	93	67	103	16	7830	1707
Palouse	14	93	67	103	16	6221	1680
Carmine	13	85	68	102	13	14310	1636
Crimson	14	84	74	104	13	12750	1609
LSD(0.05)	NS	6	1	2	1	777	221
P-VALUE	0.73	0.00	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	4.0	4.4	1.4	1.1	5.1	6.3	8.4

1/ Day 13 = 4/26/89
2/ Day 77 = 6/23/89
3/ Day 109 = 7/31/89

Fertilizer: S - 27 lbs/a & P2O5 - 44 lbs/a (broadcast pre-plant)
Crop year precipitation: 23.39"
Last spring frost: 5/21/89 (32 degrees F)
Maximum summer temperature: 96 degrees F on Aug.1

YEAR/PROJECT: 1989/758 DRYLAND PEA VARIETY YIELD TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with Dr.Fred Muehlbauer, USDA

Ten varieties of peas were seeded on 4/13/89 at 160 lbs/a. Seed had been pre-treated with fungicide. Plots consisted of four 12 foot rows with one foot row spacing and two feet between plots. Plots were later trimmed back and measured at harvest time. Harvest areas averaged 56 square feet. The experimental design was a randomized complete block with 4 replications. 'Alaska' and 'Trapper' emerged 16 days after seeding, and all the other varieties emerged 15 days after seeding. Stand establishment was very good, ranging from 98% for 'Latah' to 88% for Trapper. 'IMPCS' was the earliest to begin flowering, and Trapper was the latest. The number of nodes to first flower ranged from 12 on 'Umatilla' and Trapper to 7 on 'Columbian', 'PS410', and IMPCS. Umatilla matured significantly earlier than the other varieties, while 'Flavanda' and Trapper were the latest. Height varied from 23 inches (Flavanda) to 46 inches (Latah and Trapper). Trapper's seeds were significantly smaller than any other's with 3388 seeds per pound. Flavanda and Umatilla had the largest seeds, 1992/lb. and 2020/lb., respectively. There was a 25% difference in yield between Flavanda, the highest yielding variety, and Trapper, the lowest yielding. Flavanda had significantly higher yield than Latah which has been the standby spring yellow pea variety. Flavanda produced the most seed in the 1988 trial also, suggesting it may be a good variety to recommend as a dryland crop for this area.

PEA VARIETY TRIAL - KALISPELL, 1989

VARIETY	EMERG days 1/	STAND %	1st FLW days 2/	NODES	MATUR days 3/	HT in	SEED no/lb	YIELD lbs/a
Flavanda	15	93	62	11	102	23	1992	2497
PS510	15	96	60	11	98	43	2368	2253
PS310	15	97	61	11	100	40	2318	2170
Umatilla	15	96	61	12	96	44	2020	2136
Latah	15	98	59	9	100	46	2305	2018
Columbian	15	95	55	7	100	44	2498	2015
PS410	15	97	58	7	99	41	2407	1968
Alaska	16	97	57	8	100	44	2446	1963
IMPCS	15	95	54	7	98	40	2524	1959
Trapper	16	88	68	12	103	46	3388	1885
LSD(0.05)	<1	3	1	1	2	5	143	243
P-VALUE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CV(s/mean)	2.2	2.4	0.9	6.8	1.5	7.8	4.0	8.0

Seeding date: 4/13/89
1/ Day 15 = 4/28
2/ Day 54 = 6/6
3/ Day 102 = 7/24

Fertilizer: S - 27 lbs/a & P2O5 - 44 lbs/a (broadcast pre-plant)
Crop year precipitation: 23.39"
Last spring frost: 32 degrees F on May 21
Maximum summer temperature: 96 degrees F - Aug.1

YEAR/PROJECT: 1989/758 SPRING RAPESEED VARIETY TRIAL

PERSONNEL: Leader - Leon Welty
Research Specialist - Louise Prestbye
In cooperation with SERASEM, Ferme de la Cueillerie, PREMESQUES, 59840 PERENCHES, France

Two varieties of spring rapeseed, 'Cesar' and 'Drakkard', were received from UNCAC/SERASEM and were planted on 4/25/89 at 9.6 lbs/acre. On 4/28 80 lbs of 0-44-0 (30 lbs P205/a) and 200 lbs of 34-0-0 (68 lbs N/a) were applied.

Stand establishment after emergence was at least 95% for all plots. First bloom occurred on June 26 for Drakkard and on July 1 for Cesar. Drakkard matured on Aug.14 and Cesar on Aug.18 Cesar was 46 inches tall at maturity, and Drakkard was 42 inches tall. All plants from each plot were cut and bundled and thrashed when dry. A harvest area of 55 sq.ft. was used to determine yields. Cesar yielded 1452 lbs/a seed, and Drakkard yielded 1435 lbs/a. These means were significantly different according to T values obtained in a pairwise comparison test.

SPRING RAPE TRIAL 1989 KALISPELL, MT, USA

VARIETY	1st Bloom date	HEIGHT in	YIELD lbs/a
Cesar	7/1	46	1452
Drakkard	6/26	42	1435

Planting date: 4/25/89
Seeding rate: 9.6 lbs/a
Stand: 95% for both varieties
Harvest area: 55 sqft
Maturity date: Cesar - 8/18; Drakkar - 8/14
Fertilizer (4/28): 30 lbs P2O5/a; 68 lbs N/a
Crop year precipitation (Sept.'88 - Aug.'89) = 23.38"
Maximum summer temperature: 96 degrees F on 8/1
Last frost in spring: 32 degrees F on 5/21 (avg.- 5/25)
First frost in fall: 29 degrees F on 9/9 (avg.- 9/13)